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AUTHOR Copa, George H.; Irvin, Donald E., Jr.
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ABSTRACT

In the first half of this report a format or framework is outlined for displaying occupational supply and demand information for use in planning education for work programs. In the second half, the use of the procedure is demonstrated by filling in the format with Minnesota supply and demand information (1970-71) and drawing from it illustrative implications for planning occupational education programs. Advantages listed for the proposed format are the following: (1) identifies the alternative sources of occupational supply (high school graduates, postsecondary vocational school graduates, college graduates, those leaving the military, those previously employed or unemployed), (2) describes the size and contribution of each (as a total number of individuals or positions, respectively, and as a percentage showing relative size), (3) allows implications to be drawn for planning at the adult level (for those changing jobs, needing updating to keep their job, or re-entering the labor force) as well as postsecondary, secondary, and elementary school level (those needing awareness, orientation, exploration, or preparation), (4) adapts to various size geographic areas (state, economic region, county) and time period (one year, five years), and (5) insures the ability to test, through simulation, the potential consequences of making various changes in the sources of occupational supply or demand (e.g., through educational programs) as a means of altering either the supply or demand or both. The Minnesota data and documentation of its sources and calculations are appended. (JT)

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OCCUPATIONAL SUPPLY and DEMAND INFORMATION:
A Format with Implications for Planning Education for Work

George H. Copa and Donald E. Irvin, Jr.

September, 1974

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
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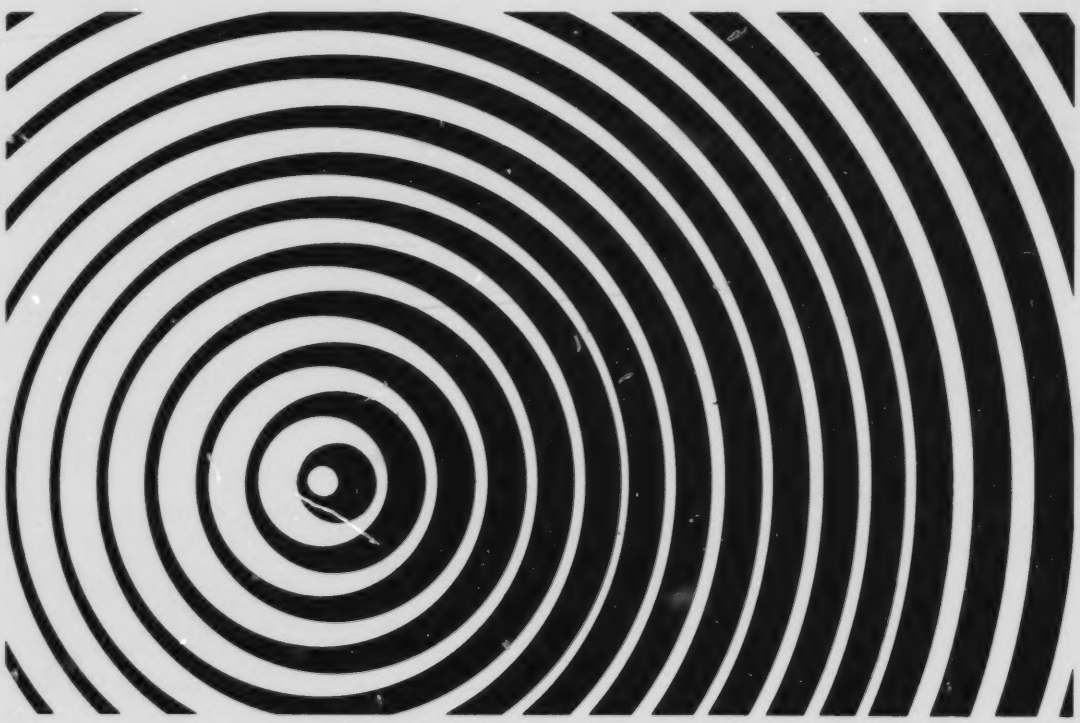

Minnesota Research Coordinating Unit
for Vocational Education
University of Minnesota
Minneapolis, Minnesota 55455

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PREFACE

Planners of educational programs directed at preparation for the world of work have often cited the need for information about occupational supply and demand. A longer range concern cited far less often is, "How would I use the information if I had it?" Chapter I of this report attempts to provide a format for defining occupational supply and demand which is adapted to its potential use as one input in planning education for work programs. The derivation of occupational supply and demand is demonstrated in Chapters II and III, respectively, to illustrate the kind of information which the format would necessitate and to assess its availability. The value of the format in describing the difference between supply and demand and in identifying alternative means of modifying occupational supply is described in Chapter IV. The ultimate purpose, a set of implications from the information about occupational supply and demand for planners of education for work programs is proposed in Chapter V. The implications are directed at the types of decisions these planners make--that is, who will be served, how many to serve, what to offer, when to offer and where to offer. These implications are an attempt to explicitly identify how information on occupational supply and demand might be useful in planning education for work. Through a critical review of these implications, educational planners can begin answering an even more crucial question, "How valuable is this information in planning effective and efficient education for work programs?"

The authors wish to acknowledge the review and critique of a first draft of this report by Jerome Moss, Jr., Chairman, Department of Vocational and Technical Education, University of Minnesota, Melvin Johnson, Director, Program Planning and Development Section, Division of Vocational-Technical Education, Minnesota State Department of Education, Donald Drain and Paul Thomas, Minnesota Higher Education Coordinating Commission, Rudolph Pinola, Director of Research and Planning, Minnesota Department of Manpower Services, and Edward Hunter, Deputy Director, Minnesota State Planning Agency. Their judgements reflecting a diversity of backgrounds, experiences, and responsibility provided a rigorous evaluation of the validity of the thoughts, ideas, and data presented in the report. The authors, however, take full responsibility for weaknesses remaining in this final draft.

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ABSTRACT

Awareness of occupational supply and demand is one critical input to decisions made in planning and operating educational programs directed at preparing individuals for work. One purpose of this report was to outline a format or framework for displaying occupational supply and demand information in a manner which maximizes its usefulness in drawing implications for planning educational programs. The proposed format has the advantages of: (1) Identifying the alternative sources of occupational supply (i.e. high school graduates, post-secondary vocational school graduates, college graduates, those leaving the military, those previously employed or unemployed) and demand (i.e. growth in existing firms, geographic in-migration of new firms), (2) describing the size and contribution of each source to supply and demand (i.e. as a total number of individuals or positions, respectively, and as a percentage showing relative size), (3) allowing implications to be drawn for planning education for work programs at the adult level (i.e. for those changing jobs, needing updating to keep their job, or re-entering the labor force) as well as post-secondary, secondary, and elementary school level (i.e. for those needing awareness, orientation, exploration of occupations and needing preparation for a first job), (4) adapting to various size geographic areas (i.e. state, economic region, county) and time period (i.e. one year, five years), and (5) insuring the ability to test, through simulation, the potential consequences of making various changes in the sources of occupational supply or demand (i.e. educational programs) as a means of altering either supply or demand or both.

The second purpose of the report was to assess the "state of the art" as to available supply and demand information in Minnesota and to more clearly communicate the proposed format and its usefulness in a real situation. This purpose was accomplished by filling in the proposed format for occupational supply and demand information with data for Minnesota in the time period 1970 to 1971. A "past" time period was used because more data was available, and thereby, the format could be more fully completed for illustrative purposes. In completing the format with data, many sources of data were identified and reviewed--also several gaps in data were uncovered or again documented as places for more study.

The last purpose of the report was to draw an illustrative set of implications for planning education for work programs using occupational supply and demand information. The implications were intended to be illustrative and to serve only as a basis for discussion since they were based on information from a short period of time (1970-71) and one geographic area (Minnesota) and because the information itself varied in its accuracy, being at best a meager first attempt. Hopefully, the illustrated implications will serve to emphasize and promote new thought and consideration of the uses, value, and desired format of occupational supply and demand information in planning educational programs preparing individuals for work as a prerequisite to constructing complex and expensive supporting information systems.

CHAPTER I

OCCUPATIONAL SUPPLY AND DEMAND INFORMATION: A FORMAT

Decision makers given the responsibility of planning educational programs designed to prepare persons for work must be aware of occupational supply and demand.[1] Awareness of these two concepts and the forces affecting them provides one input to decisions which can help insure that both the needs of the individual and society are fulfilled. Work is one role in which an individual can satisfy some of his/her needs, particularly the need for economic security. Society needs individuals to work at various occupations if the society is going to be maintained and grow. Therefore, for both society and individual, the filling of a work role is an important source of satisfaction. Work is defined as the purposeful activities of an individual which produce, process, or distribute goods and services and which are intended to result in immediate wage earnings or income saving for the individual or his assigns. "Occupation" is an abstraction which describes the expectant behaviors of a similar set of work roles; it is a means of classifying various types of work according to the skills, knowledge, and attitudes needed to perform the work.[2]

Planners of programs designed to prepare persons for work will be most effective (in terms of generating satisfaction) when there is some degree of correspondence between the number of individuals preparing for certain types of occupations and the number of positions available to be filled in these occupations. Individuals prepared for occupations for which there is no demand and occupations for which there are no available employees are sources of disatisfaction to the individual and society, respectively. For this reason, an awareness of occupational supply and demand by those planning education for work is essential. Essentiality is based on the assumption that education for work programs constitute <u>one</u> of the forces which can

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[1]The "Amendments to the Vocational Education Act of 1963", Public Law 90-576, 90th Congress, H.R. 18366, October 16, 1968, which is a major piece of legislation directed at educational programs designed to prepare persons for work, states that vocational education should be ". . . realistic in the light of actual or anticipated opportunities for gainful employment" (p.6). The "Morrill Act" establishing land grant universities outlined one of their leading purposes to be "teach such branches of learning as are related to agriculture and mechanical arts. . . in order to promote liberal and practical education of the industrial classes in the several pursuits and professions of life" (Sec. 4). The Manpower Development and Training Act of 1962 outlines its general purpose to be "that it is in the national interest that current and prospective manpower shortages be identified and that persons who can qualify for these positions through education and training be sought out and trained" (Sec. 101).

[2]The use of "satisfaction" in the work role by the individual and society as a criterion for evaluating education for work and the definition of work are treated in detail in a paper by Moss, Jerome Jr., Brandon B. Smith, and George Copa, "Some Major Concepts in a Rationale for Education for Work" (Career Education), unpublished paper, 1972.

influence the quantity and quality of occupational supply. The limitations of education for work programs is that it is only one of several factors affecting occupational supply (i.e. supply is very conditional on price and utility associated with activities alternative to work roles such as family and leisure).

Since planners of education for work programs rarely make decisions about whether or not to drop all education for work but rather what marginal changes should be made, the knowledge of difference in supply and demand is particularly relevant. This difference represents one indicator of the marginal changes which may need to be made in these programs.

OCCUPATIONAL SUPPLY

Occupational supply in this report is defined theoretically as all individuals who have or seek to have a work role — they want to work and can perform at acceptable levels if given the opportunity. Operationally, the definition includes individuals who are presently working as well as individuals who are unemployed but looking for work. All individuals available for work are termed the "supply pool". Individuals enter and leave the pool at various times during their lifetime. Everybody not in the supply pool is termed "unavailable for employment". The flow of individuals into and out of the supply pool is shown in Figure 1.

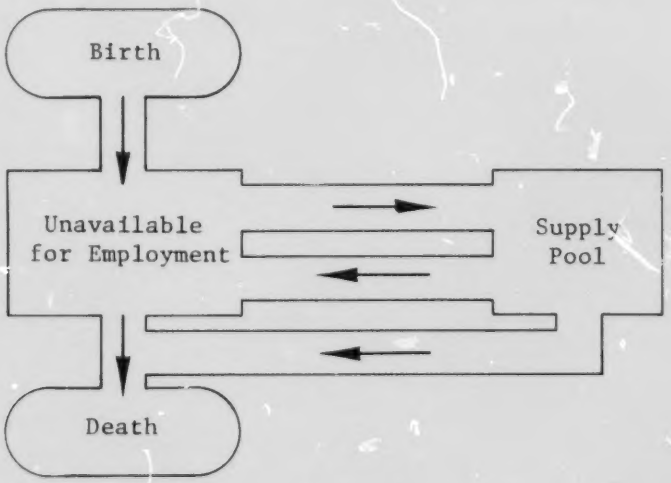

Figure 1. Flow of Individuals To and From Supply Pool

As shown in Figure 1, the individual enters the flow at birth and leaves at death. In between these two end points in life, the individual is either unavailable for employment or in the supply pool (available for employment). While unavailable, the individual could be in school, physically or mentally unable to work, retired or in other situations where he is not working and does not want to work. Individuals in the supply pool can be categorized by the occupation (i.e. crafts-

man, operative, sales) which he has or for which he is looking. Some individuals who are unavailable for employment (i.e. those in the last years of their schooling) may also be classified by the occupation they will try to find when they leave the unavailable group.

The place of education in this flow of individuals into and out of the supply pool is shown in Figure 2. Education is viewed as an enlargement in the tube feeding supply from those unavailable. This enlargement is also fed from individuals already in the supply pool. Individuals flow through the process of education and become a new part of or return to the supply pool; they also have the option of flowing back to the unavailable category. In this concept, education is viewed as a holding area while individuals are changed in some way (one of which may be their extent of preparation for work).

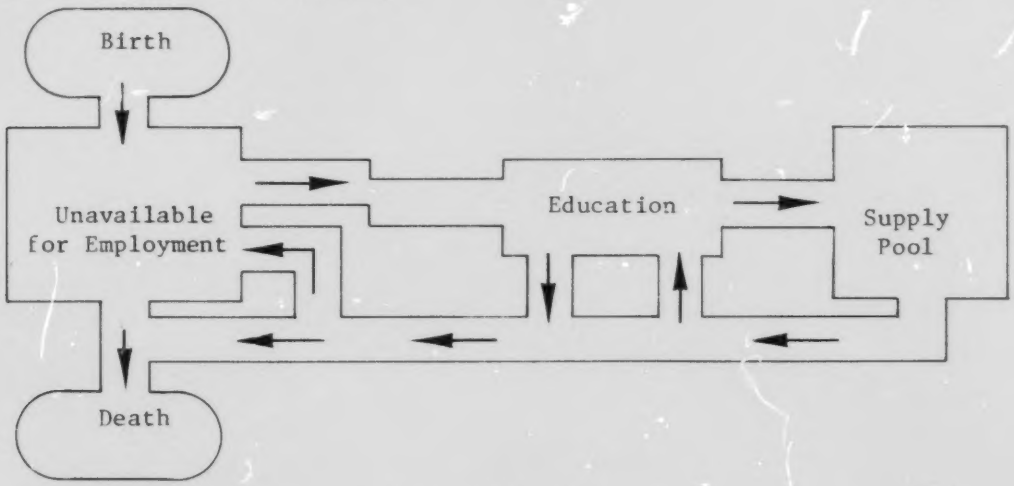

Figure 2. Place of Education in the Flow of Individuals To and From the Supply Pool

Education as diagrammed in Figure 2 is thought of as the more formal process composed of planned organized learning activities usually occurring in educational institutions and agencies (i.e. elementary schools, high schools, post-secondary vocational institutes, junior colleges, universities, manpower training programs, apprenticeship programs). These sources provide education to various age groups, for several different purposes, and maintain various relationships with the supply pool. One of the purposes is to prepare individuals so that they are able to work at an occupation which is satisfying for the individual and of use to society.

The supply pool, although dynamic in nature, can potentially be categorized by size and type of occupation, time period (i.e. present, 1975, 1980, 2000) as well as geographic location (i.e. United States, Minnesota, Economics Region 9, Steele County, Owatonna). All of these descriptions are necessary to an accurate definition of supply for use in planning educational programs. The reason is that education programs, designed at least partially to prepare persons for work, must be planned in terms of size (who and how many will be prepared), type (for what kind of occupation will the program prepare), schedule (when should the program

be started, how long should it run), and location (where should the program be located).

Using the diagram shown in Figure 2, individuals can be classified into one or more of three categories at a given point in time—in education, in the supply pool, and unavailable for employment. Although it would be possible to formulate a set of mutually exclusive categories by considering all combinations of what individuals might be doing (i.e. in education and unavailable), for explanatory purposes the situation can be simplified by classifying individuals by their major activity. When individuals are classified into only one category, the population can be represented by an array of categories for a given time (i.e. Time x) as shown in Figure 3. The "x's" in the box represent a count of individuals in each category at Time x. Births represent new individuals to be categorized; deaths represent individuals to be removed from the categories.

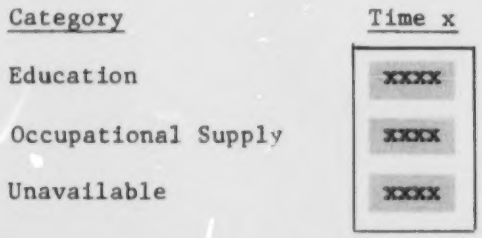

Figure 3. Categories of Individuals in Relationship to Occupational Supply for a Given Time and Geographic Area

The categories represented in Figure 3 can be further subdivided into additional categories. Those in the supply category can be divided into those who are employed and unemployed. (The separation of these groups will be important later in comparing supply and demand and drawing implications for planning education for work programs.) The unavailable category can be divided into a pre-education category and others. The pre-education category is for those who are under formal school age. The remaining individuals in the unavailable category are those mainly over high school age. The set of categories of individuals for a given time period can then be represented as in Figure 4.

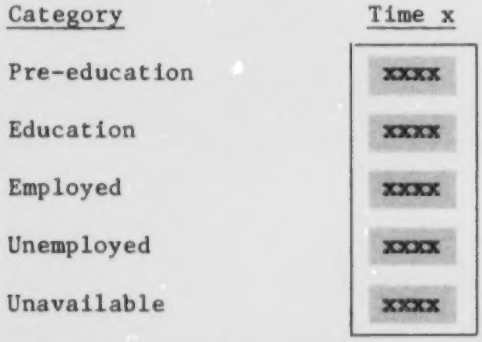

Figure 4. A More Specific Set of Categories of Individuals in Relationship to Occupational Supply for a Given Time and Geographic Area

As was done for Time x, a similar distribution of individuals across categories could be shown for other time periods (See Figure 5). The array of categories for each time period is a static description of "where individuals are at" at a selected time.

Category	Time x	Time x + 1	Time x + 2	Time x + n
Pre-education	xxxx	xxxx	xxxx	xxxx
Education	xxxx	xxxx	xxxx	xxxx
Employed	xxxx	xxxx	xxxx	xxxx
Unemployed	xxxx	xxxx	xxxx	xxxx
Unavailable	xxxx	xxxx	xxxx	xxxx

Figure 5. Distribution of Individuals in Categories Related to Occupational Supply Over Several Time Periods

The dynamics of this means of describing the population with respect to its status relative to the occupation supply pool occurs between time periods; it is the reshuffling of individuals between categories from one time period to the next. This reshuffling or redistribution can be described in a matrix of cells as shown in Figure 6. Figure 6 shows the change from Time x to Time x + 1. Each cell of the matrix contains the number of individuals in a selected category in Time x (i.e. education) and another selected category in Time x + 1 (i.e. employed). The matrix describes the flow or transition of individuals between and among categories from one time period to another.[3]

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[3] See Correa, Hector. Quantitative Methods of Education Planning, International Text Book Company: Scranton, Pennsylvania, 1969, or Thonstad, Tore. Education and Manpower: Theoretical Models and Empirical Applications, University of Toronto Press: Canada, 1968, for a more complete description of the use of transition matrices in educational planning.

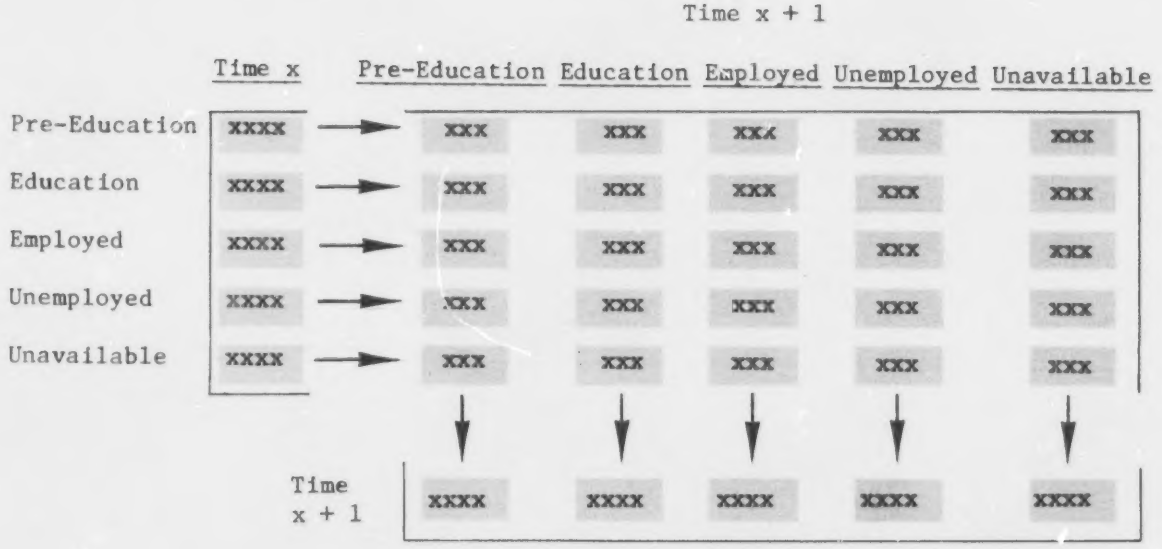

Figure 6. Flow of Individuals Between and Within Categories Related to Occupational Supply from One Time Period to the Next

In order to completely describe the change occuring from one time period to another, it is necessary to add the individuals newly entering the population, (births),and those leaving the population,(deaths). If the matrix is to describe the population in a particular geographic area, the impact of geographic mobility must also be included. In-migration can be treated like births while out-migration is similar to deaths. Adding these two additional elements to the matrix would make it appear as in Figure 7.

Figure 7 then shows the complete flow of individuals in the population of a selected geographic area from one time period (Time x) to another (Time x + 1). As an illustration of flow, the individuals who are in the education category in Time x may still be in the same category in Time x + 1 or have moved to the employed, unemployed, unavailable, moved out of area, or death category. The number in each cell of the matrix indicates level or quantity of flow from one category to another between time periods. As noted earlier, occupational supply is made up of those in the employed and unemployed categories. The cells with numbers in them for the employed and unemployed columns of Figure 7 represent Time x categories which contribute to occupational supply in Time x + 1 - in effect they identify the delivery system for supply. The numbers in the cells of these columns describe the contribution to supply by each of the respective sources of delivery (i.e. categories in Time x).

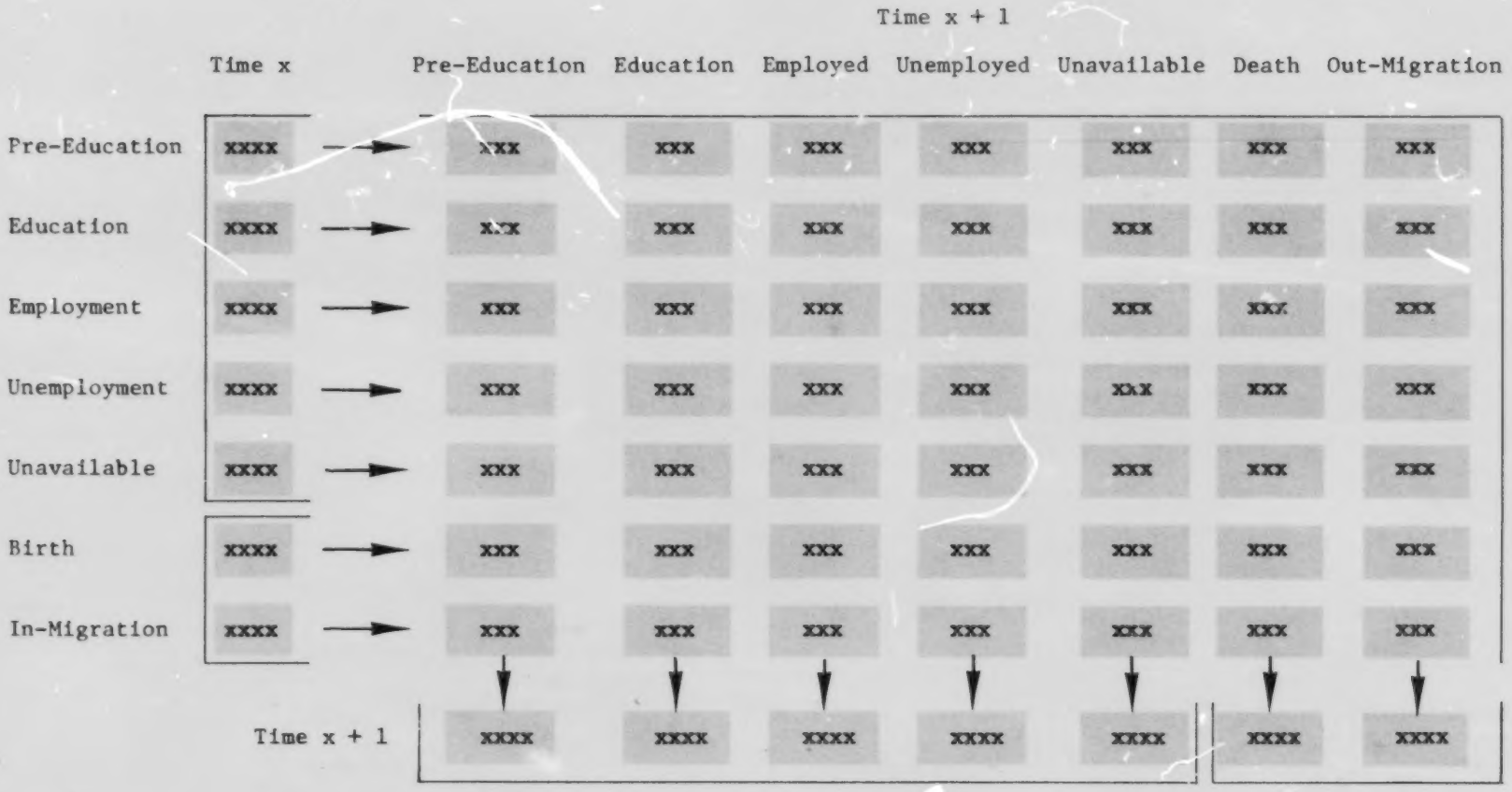

Figure 7. Flow of Individuals Between and Within Categories Related to Occupational Supply From One Time Period to the Next for a Selected Geographic Area Including New Entrys and Exits from the Population

If the number in each transition cell is changed to a percentage by dividing it by the total number of individuals in the corresponding Time x category, the matrix represents a distribution or mobility pattern of individuals between and among categories from one time period to another. Given that the percentages were constant over time and represented the flow from one year to the next, derivation of occupational supply in five years could then be made by passing the total population (adding the births and in-migration and subtracting the deaths and out-migration) through the matrix four times. It would not be necessary to assume the percentages were the same from year to year if one had reason to believe they would be changing and the change could be estimated. In the case where a percentage in a particular cell was changing, it would only be necessary to make the needed cell changes with each succeeding pass through the matrix. Where changes cannot be estimated, it may be useful to make simulated changes to observe the sensitivity of occupational supply estimates. Herein lies the advantages of the proposed format from a planning perspective — the ability to make simulated changes in the system and see short run as well as long run consequences.

The completed matrix as described allows the determination of occupational supply, its sources, and their relative importance. The Time x categories represent pools of individuals with common characteristics with respect to their relationship to occupational supply. Using an analogy to a plumbing system, the cells of the distribution matrix represent pipes between and among categories from one time period to another. The percentages in the cells represent a reading on a gauge measuring the flow of individuals through the pipe. The Time x + 1 categories are the new pools created by the flow of individuals through the cells (connecting pipes). Use of a flow matrix to describe how occupational supply is created also allows the testing of alternative strategies of altering occupational supply at some time in the future. Since the flow of individuals from several sources of occupational supply requires or is enhanced by education for work, alternative strategies aimed at altering supply have direct implications for planning education for work programs. It must be recognized, however, that factors other than education for work may have a much larger influence on supply such as the relative price paid for labor between occupations and geographic areas, birth and death rates, length of compulsory school attendance, labor force participation rates, and occupational demand. It is likely that given these other factors affecting occupational supply, that planning education for work programs is at best only one of several means of altering supply in significant ways. To be effective it must take into account the influence of these other means as well as the types of changes at which education for work programs are relatively more effective and efficient.

Regardless of the factors affecting occupational supply, its derivation can be effectively described through a flow matrix such as shown in Figure 7. The next section will treat occupational demand as another variable with which planners of education for work programs must contend.

OCCUPATIONAL DEMAND

Occupational demand represents the needs of society in terms of work needed to be done. Demand is defined theoretically as the work roles (occupations) needed by society in order to meet its desired rate of growth and provide the goods and services demanded by its constituents. Operationally, in this report, the proxy measure is defined as number of employment positions within the labor force. Demand can be characterized in dimensions similar to supply: Size (how many positions are available), type (what kinds of occupations are represented by the positions), time (when will the positions be available), and location (where geographically are the positions located). As with occupational supply, demand can also be characterized by the price at which the demand is made and the specific requirements for job entry. Demand is made up of all available positions - those already filled by an employee and those not yet filled. Demand for some future period is derived by counting the number of employment positions available at present in a given geographic area and adding (or subtracting) the estimated growth (or decline) in positions between now and the future time period. Growth in positions can occur by firms in the geographic area expanding and thereby adding new positions or by the geographic in-mobility of new firms into the area in question. Decline in position between time periods can occur through a reduction in positions by existing firms and the geographic out-migration of firms from the area in question. Using Time x to designate the present and Time x + 1 for the future time period, these relationships can be diagramed in a flow chart similar to that used with occupational supply as shown in Figure 8.

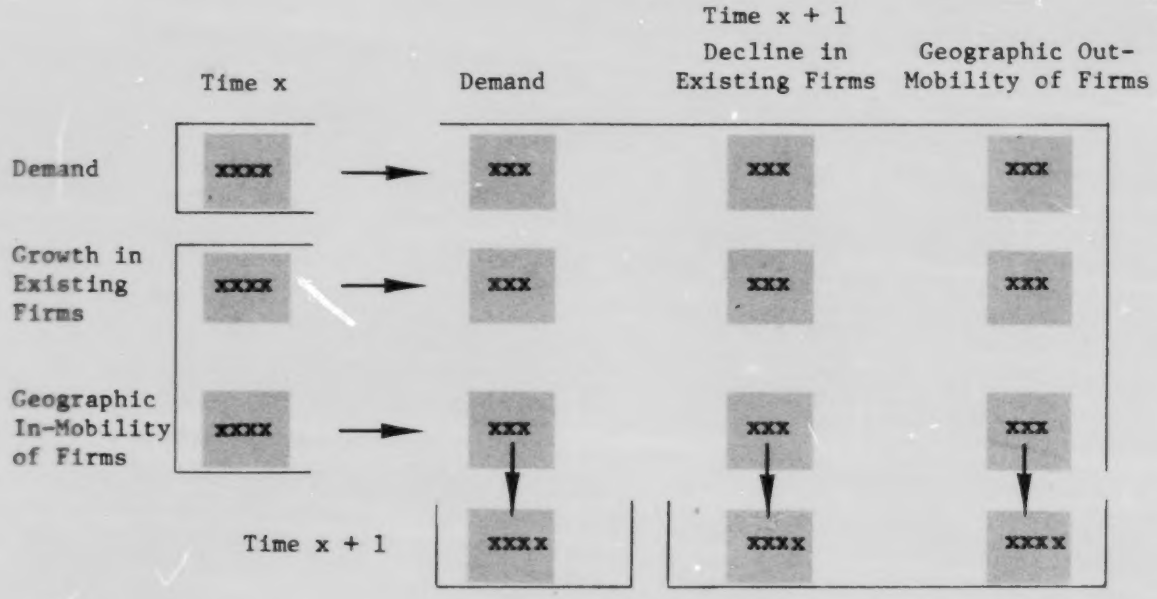

Figure 8. Flow of Positions Between and Within Categories Related to Occupational Demand from One Time Period to the Next for a Selected Geographic Area

COMPARISON OF OCCUPATIONAL SUPPLY AND DEMAND

The comparison of occupational supply and demand is a simple comparison of the description of supply and demand in terms of number, type, time, and location at a given level of wages. The differences and similarities which become apparent are one input into decisions about alternative strategies which may invoke changes in what supply or demand will be at some time in the future. It is assumed that the end point would be to approach as close a correlation as possible (and economically feasible) between supply and demand over time and geographic area such that both individuals and society in total would be most satisfied. A comparison of supply and demand for a particular time and location is diagrammed in Figure 9. Since educational planners have their major effect on the supply rather than demand, they can attempt to reduce any difference between supply and demand by altering sources of supply which are educational in nature. Note however that changes caused by educational planners are only one means of altering supply or demand and may be less effective than a change in price or market conditions. A reduction in difference would be a feasible change as long as it increased the overall satisfaction for individuals and society in total and given that resources to make the change are available. The supply delivery system described by the matrix shown in Figure 7 outlines the potential alternatives where change effected by educational planners might take place. The numbers in the cells of the matrix indicate in which sources a change might have the greatest effect on supply. Presumably, the decision maker will make those changes which are judged at the margin to be most effective as compared to cost in bringing about a closer correspondence of supply and demand resulting in an increase in satisfaction to individuals and society over time and across geographic areas.

The changes about which decisions could be made might involve a change in the number of persons moving through a source of occupational supply, the type of occupation for which individuals are prepared in sources of supply, the time at which sources of supply make their contribution and the location, geographically, of the sources of supply. Since education for work programs make up several of the sources of supply or can influence other sources, it is assumed they can be an important means of implementing decisions to bring supply and demand into mutually rewarding correspondence for individuals and society.

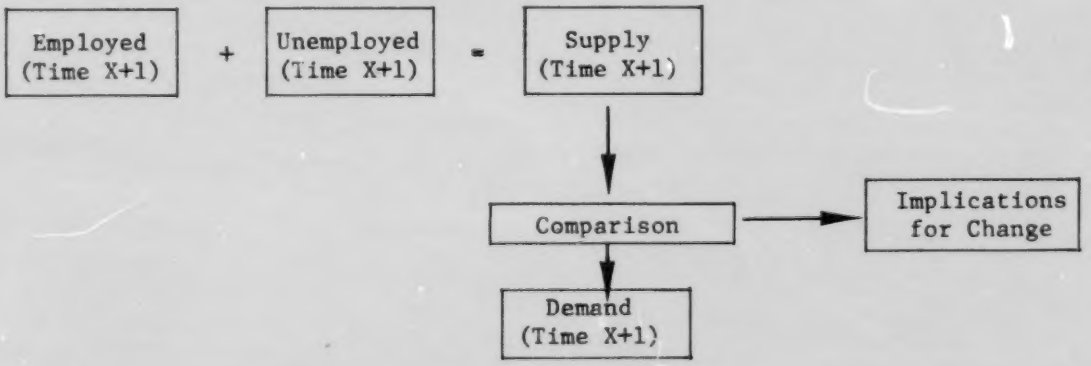

Figure 9. A Comparison of Occupational Supply and Demand for a Particular Time and Location

Note, however, that their influence is only on the supply side of the labor market - occupational demand is taken as a given. With this constraint it is obvious that manipulation of sources of supply will not always lead to a maximization of individual and societal satisfaction in the work world. For example, should more individuals want work roles than there are work roles demanded by society (i.e. supply exceeds demand), manipulation of only supply will result in suboptimal satisfaction. Note that the delivery system for occupational demand shown in Figure 8 identifies alternative means by which demand at a particular time and location can be affected (i.e. by increasing the geographic in-mobility of firms). With the constraint of demand being a given, a reasonable strategy for planners of education for work is to use their resources so as to maximize potential satisfaction of individual and society over time. Operationally this means allowing equal opportunity for participation in education for work programs even to the extent of preparing more individuals for work than there are positions if such preparation will result in greater potential mutual satisfaction to individual and society than use of the required resources in another way. Assuming that all occupations are of equal importance in terms of generating satisfaction to individuals and society (which is probably not true but represents the simplest case) and that occupational demand is a given, a fair criterion for use in planning education for work would be to strive to maintain an equal ratio of supply to demand across all occupations. All individuals and occupations (from society's perspective) would be equally affected no matter if supply was less than, equal to, or more than demand. As the assumption of equal importance of occupations for individuals and society is relaxed, the ratios of supply to demand may justifiably differ across occupations.[4]

In the case where supply exceeds demand, it would be prudent for society to somehow increase the number of work roles if satisfaction is to be maximized for both individuals and society. In effect, what is said is that education for work programs cannot eliminate unemployment if in fact supply exceeds demand (unless all the unemployed are kept in school until jobs are available). In this situation, education for work programs can only increase the opportunity for employment (realizing that if one individual, because of his new preparation, can get a job, it may mean that someone else - less prepared - will not get the job or may even lose a job). This has the effect of increasing the general quality of the work force and, therefore, the satisfaction of society but is unfair to the individuals who are unable to compete with or are being replaced in their work roles by others who are better prepared, unless there is an opportunity for the individuals who can't compete or being replaced to somehow prepare for yet another work position or increase their satisfaction in a non-work role.

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[4] A more complete explanation of the context and strategies for planning vocational education programs will be dealt with in a forthcoming publication of the Minnesota Research Coordinating Unit for Vocational Education.

SUMMARY

Planners of education for work programs must be knowledgeable about occupational supply and demand if the programs they plan are to be effective in maximizing the mutual satisfaction of individuals and society. Occupational supply is a summary of the demands of individuals for work roles in terms of number, type, time, and location. Work roles are one source of satisfaction particularly from an economic perspective for these individuals. Occupational demand is a summary of the demands of society for work roles it needs filled in order for society to be maintained and grow. Society's demands can also be characterized by number, type, time, and location. Both supply and demand are relative to wages at a particular time and location. It is assumed that the mutual satisfaction of both individuals and society from the work world would be enhanced with a better correspondence of supply and demand in terms of numbers, type, time, and location.

Education for work programs have as their major purpose the preparation (either initially or in a continued capacity) of individuals for work roles. With this purpose they are a viable means of altering occupational supply given a picture of occupational demand. For this reason, planners of education for work programs must be aware of occupational supply, occupational demand, and their differences. Knowledge of the differences are particularly relevant in making marginal changes in planning programs.

With this need in mind, a format for describing and determining occupational supply and demand was outlined. The format was tailored to provide not only an estimate of supply and demand but an identification of the alternative sources of supply and demand and their relative importance. For the purposes of this report, occupational demand will be assumed to be unchangeable by education for work programs. This would not have to be the case if the report was directed at those planning for the whole economic sector rather than only planners of education for work programs.

The next two chapters will deal with a demonstration of the determination of occupational supply and demand. Later chapters will deal with the comparison of supply and demand and the implications of this information for planners of educational programs directed at preparation for work roles.

CHAPTER II

OCCUPATIONAL SUPPLY DETERMINATION: A DEMONSTRATION

The preceeding chapter of this report dealt with the importance of information on occupational supply and demand for decision makers planning educational programs which have as one of their purposes the preparation of individuals for work. Also described in the chapter was a format for describing occupational supply and demand. This chapter will illustrate quantitatively the description of supply and its delivery system using the previously described format, that is, a flow matrix.

Rather than use artificial data, an attempt was made to describe the "real world" of occupational supply in a particular geographic area (Minnesota) for a particular time period (1970-1971) as clearly as possible given the data available. However, much data was lacking and many subjective judgements were made in order to accomplish this task. These points should be kept in mind when making any interpretation or generalizations from the data presented. Hopefully the use of the best data which could be found will help make the demonstration as realistic and therefore as informative as possible for the later chapter dealing with the implications of this information for planning education for work programs. All data sources which were used are documented--which was no small task in itself. Perhaps this documentation will serve as a first step in identifying what information is available and where; more importantly, it will identify the gaps in available information which need to be filled if an accurate assessment of occupational supply is to be made. It was decided to use a time period from the past (1970-1971) because more data was available for past as compared to future time periods.

SOURCES OF SUPPLY

The total supply for Minnesota is defined as those persons available to fill work positions created by demand across all occupations within the State. The flow matrix used to describe supply and its delivery system indicates the movement of people within and between a series of categories. These categories represent the status of the individuals in the category with respect to their availability for work in a given year (1970 or 1971). The categories and subcategories of individuals and the total number of individuals in each category in 1970 is shown in Table 1.

The birth category of Table 1 includes all individuals born between January 1 and December 31 of 1970 (1)[5]. The pre-school category contains all individuals

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[5] The numbers in parentheses are references to specific calculations found in Appendix III.

TABLE 1

Categories of Persons with Respect to Availability for Work in 1970 in Minnesota

Category	Total Number in 1970
Birth	66,448
Pre-School	265,323
Elementary School	584,087
Secondary School	458,991
Post-Secondary College	135,200
Post-Secondary Vocational	32,110
Professional	229,980
Managers	125,904
Clerical	252,128
Sales	102,458
Craftsmen	183,735
Operatives	210,701
Service	196,459
Laborers except Farm	58,457
Farmers & Farm Workers	104,451
Unemployed	64,163
Military	49,555
Unavailable	872,902
TOTAL	3,993,052

born before January 1, 1970, who are under the age of five years (2). Individuals enrolled in grades K through 6 comprise the elementary school category (3). The secondary school category is comprised of individuals enrolled in grades 7 through 12 (4). Persons in post-secondary educational programs are divided into post-secondary college and post-secondary vocational categories (5). The post-secondary college category is composed of the sum of persons enrolled in four year colleges and universities, both public and private and two year colleges, both public and private. The post-secondary vocational school category includes persons in public vocational-technical institutes, private vocational schools and Manpower Training and Development Administration (MDTA) sponsored programs in the State. These two categories represent a count of persons who are spending a major share of their time in an educational institution or agency which may have as one of its purposes the preparation of individuals for work. To the extent that persons in post-secondary college and vocational categories are also employed, there is a double count of such individuals. A category for persons in apprenticeship or on-the-job training programs was not included because these individuals were assumed to be spending a major share of their time working and are therefore already included in the categories of employed persons.

The categories of employed persons (6) include a category for persons employed in each of the following occupational categories: Professionals, managers, clerical, sales, craftsmen, operatives, service, laborers, and farmers.[6] In theory, these categories should be a count of the number of persons who sought and were able to find a job in each of the listed occupational groups at a particular time (1970) and in a particular geographic area (Minnesota). A finer breakdown of occupational groups was not attempted because information on sources of entrance to occupations was limited even for these categories. The unemployed category (7) is the average number of persons who were unemployed at any particular time during the year. This category should represent a count of persons who were seeking but were not able to find a job.

The military category includes those individuals who are full time in the military service (8) and generally not available for civilian employment. The unavailable category is composed of all individuals not categorized in a previously described category (9). It is thought to be composed of individuals who are retired, inmates of institutions (i.e. penal institutions, hospitals), and those spending the major share of their time maintaining a household (see footnote 6). This category contains those individuals who are not available for

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[6] Another major occupational category which should be included with the employed is "those maintaining households". These persons are working according to the definition of work provided earlier (see page 1) - they are engaged in activities which produce, process or distribute goods and services and which result in immediate income saving for the individual or his assigns. An occupational category for this group was not included because much of the necessary information was lacking, however, they should be a part of further implementation of this approach to determining occupational supply.

work for reasons other than being in the previously defined sources of education.

The above categories were designed to describe the entire population of the selected geographic area in terms of availability for work. The categories represent those unavailable for employment, including the intermediate steps in becoming available, as well as those available for employment. The flow matrix described next shows the flow of individuals between and within these categories from 1970 to 1971 (a period of one year). For the year 1971, the unavailable category also includes those exiting from the population because of death. The resulting distribution of individuals in 1971, into the employed and unemployed categories, will define occupational supply in 1971. The numbers in various cells of the matrix will indicate the relationship of various categories. Of primary concern in this report, are the categories which relate to an increase or decrease in occupational supply. In this demonstration, it was assumed that there was no geographic mobility into or out of the State since data on mobility by occupational group was not available.

A picture of the matrix and its major categories for 1970 and 1971 is shown in Table 2. As stated earlier, an attempt was made to locate available data about each category of individuals in order to complete the flow matrix. A copy of the full matrix is provided in Appendix I. The data and how it was used to complete the matrix is described in Appendix II. Specific calculations are shown in Appendix III. The base year, year X, used in this report was 1970. Therefore, the numbers and percentages presented in the flow matrix indicate the number and percent of the total number of individuals in a particular category in 1970 who were in a given category in 1971, year X + 1. A summary of the matrix presented in Appendix I is shown as Table 3.

DERIVED OCCUPATIONAL SUPPLY

One of the objectives of completing the flow matrix as described in Appendices I through III was to demonstrate how occupational supply in a future period can be derived from the supply delivery system described in the flow matrix.

Supply has been previously defined as those individuals who are available to take work positions - it includes the employed and unemployed. Unemployed is defined as those who are not working but are seeking and are able and available for work. Derived occupational supply for 1971 in Minnesota is therefore a sum of the number of individuals in the employed and unemployed categories for 1971 in Table 3. These numbers are shown in Table 4. As shown in Table 4, a total of 1,565,960 individuals were categorized in supply categories in 1971. Of these, approximately 95.4% were employed and 4.6% were unemployed.

The employed group can be further divided into occupational categories. The sum of individuals who entered each major occupational category is derived by summing across all rows of the flow matrix (shown in Appendix I) for the occupational categories (columns) and is shown in Table 5. The data in Table 5 represents the most specific estimate of occupational supply made in this report. The next section will concentrate on the direct sources of supply and their relative importance.

TABLE 2

Categories Used to Describe the Status and Flow of Individuals Between 1970 and 1971 with Respect to Occupational Supply

FROM \ TO		Category in 1971								
Category in 1970	Total in 1970	Pre-School	Elementary	Secondary	Post-Secondary College	Post-Secondary Vocational	Employed	Unemployed	Military	Unavailable
Birth										
Pre-School										
Elementary										
Secondary										
Post-Secondary College										
Post-Secondary Vocational										
Employed										
Unemployed										
Military										
Unavailable										
Total in 1971										

TABLE 3

Summary of Flow of Individuals Between 1970 and 1971 with Respect to Occupational Supply for Minnesota.

From Year 1970 / To Year 1971 Category	Total	Pre-School	Elementary	Secondary	Post-Secondary College	Post-Secondary Vocational	Employed	Unemployed	Military	Unavailable
Birth	66,448	65,252	0	0	0	0	0	0	0	1,196
Pre-School	265,323	195,013	70,045	0	0	0	0	0	0	265
Elementary	584,087	0	496,240	87,613	0	0	0	0	0	234
Secondary	458,991	0	0	393,363	22,691	9,330	19,052	2,303	4,546	7,706
Post-Secondary College	135,200	0	0	0	106,849	2,548	20,203	3,760	1,701	139
Post-Secondary Vocational	32,110	0	0	0	276	8,526	17,025	1,794	2,639	1,850
Employed	1,464,273	0	0	0	0	0	1,355,290	60,257	5,228	43,498
Unemployed	64,163	0	0	0	0	0	58,864	3,458	0	1,841
Military	49,555	0	0	0	1,716	816	16,789	208	30,229	0
Unavailable	872,902	0	0	0	0	0	6,958	0	0	865,945
TOTAL	3,993,052	260,265	566,285	480,976	131,532	21,220	1,494,180	71,780	44,140	922,674

TABLE 4

Derived Occupational Supply for 1971 in Minnesota

Category	Total Number
Employed	1,494,180
Unemployed	71,780
TOTAL SUPPLY	1,565,960

TABLE 5

Derived Occupational Supply for 1971 in Minnesota for Each Major Occupational Group

Occupation	Number in Supply
Professional	234,614
Manager	137,926
Clerical	262,512
Sales	103,514
Craftsmen	189,798
Operatives	216,919
Service	193,149
Laborers	58,538
Farmers	97,210
Unemployed	71,780
TOTAL	1,565,960

CONTRIBUTIONS OF DIRECT SOURCES OF OCCUPATIONAL SUPPLY

The direct sources of occupational supply are those categories of individuals in 1970 from which individuals flow into the supply categories (employed and unemployed) in 1971. By contrast, an indirect source would be one such as the pre-school categories of individuals from which individuals do not generally flow directly into the supply categories but rather into other non-supply categories such as elementary education. Note that eventually most individuals will enter a category from which they flow directly into supply.

Sources of Total Occupational Supply

The categories of individuals in 1970 which contributed directly to supply in 1971 are shown in Table 6 (see also Appendices I and II). For each category (row) in 1970, the number of persons flowing to supply is indicated. For example, of the 458,991 individuals in secondary education in 1970, 19,052 were employed and 2,303 were unemployed in 1971. In addition to numbers, a percent entering supply is indicated to show the relative number of individuals in a particular category (row) who entered supply in 1971. For example, of the 458,991 individuals in secondary education in 1970, 4.7%, or 21,355 (19,052 employed plus 2,303 unemployed) entered supply as opposed to remaining in secondary education or flowing to some other category in 1971.

The data presented in Table 6 indicate that a very large share (about 97%) of the previously employed and unemployed individuals entered (remained in) supply in 1971. The next largest percentage was for individuals in the post-secondary vocational school category, where about 59% entered the occupational supply pool in 1971. The military was next with about 34% entering supply. Post-secondary colleges and universities had 18% and secondary schools 5% of their participants flowing into supply in 1971. Smaller percentages for these latter educational categories is to be expected because they hold students for a longer period of time than the other educational institutions or agencies mentioned.

Relative Size of Contribution of Sources of Total Supply

This section will deal with the relative size of the flow from any source of supply to the total occupational supply for 1971. Table 7 presents the pertinent information. For each category of individuals in 1970 from which there is flow into a supply category in 1971, Table 7 indicates the number flowing, and the percent of total supply in 1971 represented by this number.

From Table 7 it can be observed that the total supply for 1971 was estimated to be 1,565,960 people. People from the 1970 secondary education category comprised approximately 1.4% of this total, about 21,355 people. The influence of people

TABLE 6

Size of Flow from Direct Sources of Occupational Supply
from 1970 to 1971 in Minnesota

Category	Total Number 1970	Number Employed 1971	Number Unemployed 1971	Number in Supply 1971	Percent Entering Supply
Secondary	458,991	19,052	2,303	21,355	4.7
Post Secondary College	135,200	20,203	3,760	23,963	17.7
Post Secondary Vocational	32,110	17,025	1,794	18,819	58.6
Professional	229,980	218,113	4,439	222,552	96.8
Managers	125,904	120,515	1,573	122,088	97.0
Clerical	252,128	231,126	10,135	241,261	95.7
Sales	102,458	93,473	4,375	97,848	95.5
Craftsmen	183,735	172,251	6,853	179,104	97.5
Operatives	210,701	190,115	14,665	204,780	97.2
Service	196,459	178,876	10,393	189,269	96.3
Laborers	58,457	51,290	5,735	57,025	97.5
Farmers	104,451	99,531	2,089	101,620	97.3
Unemployed	64,163	58,864	3,458	62,322	97.1
Military	49,555	16,789	208	16,997	34.3
Unavailable	872,902	6,957	--	6,957	.8
TOTAL	3,077,194	1,494,180	71,780	1,565,960	50.9

TABLE 7

Relative Size of Flow of Direct Sources
to Occupational Supply in Total, 1970 to 1971
in Minnesota

Category	Total Entering Supply in 1971	Percent of Total Supply in 1971
Secondary	21,355	1.4
Post-Secondary College	23,963	1.5
Post-Secondary Vocational	18,819	1.2
Professional	222,552	14.2
Managers	122,088	7.8
Clerical	241,261	15.4
Sales	97,848	6.2
Craftsmen	179,104	11.4
Operatives	204,780	13.1
Service	189,269	12.1
Laborers	57,025	3.7
Farmers	101,620	6.4
Unemployed	62,322	4.0
Military	16,997	1.1
Unavailable	6,957	.5
TOTAL	1,565,960	100.0

from the 1970 post-secondary college and vocational education categories were estimated to be approximately 2.7% of the total supply, or 42,782 people. The greatest influence on the total supply was exerted by people who were categorized as employed, about 90% or 1,415,547 people. The influence of the remaining 1970 categories was as follows: People from the unemployed category comprised 4% of the total supply, people from the 1970 military and unavailable categories comprised about 1.1% and .5% of the total supply, respectively.

SUMMARY

This chapter has demonstrated how occupational supply can be derived by use of a flow matrix. The illustrative matrix is presented for the state of Minnesota in the time period 1970 to 1971.

All individuals in Minnesota were classified into a series of categories relative to availability for occupational supply. The movement of individuals between 1970 and 1971 between and within these categories is shown as a flow matrix.

The sections of the matrix which relate or contribute directly to occupational supply are singled out and more specifically described in terms of the size of flow from each direct source category in 1970 into occupational supply in total. Both the categories which increase and those that decrease supply are important when considering alternative ways of influencing (either increasing or decreasing) supply in total or for specific occupational groups.

The next chapter will deal with occupational demand after which consideration will be given to the correlation between supply and demand. After making comparisons of supply and demand, reference will be made to this chapter to identify alternative ways of influencing occupational supply.

CHAPTER III

OCCUPATIONAL DEMAND DETERMINATION: A DEMONSTRATION

Occupational demand is defined as the total number of employment positions in a given geographic area, such as state or an economic region, at a particular time and price. This characteristic describes the scope or size of an occupation in terms of total number of positions. Theoretically, occupational demand is the work role demands of society needed for maintenance and growth.

In order to illustrate how occupational demand could be derived using the procedure posed in Chapter I and in order to be consistent with the occupational supply information presented in Chapter II, demand will be estimated for the geographic area of Minnesota and the time period 1970-1971.

ESTIMATING GROWTH OR DECLINE

The Minnesota Department of Manpower Services supplies information on occupational demand in Minnesota. As a part of this function, it provided Minnesota with an estimate of occupational demand for 1968 and 1975.[7] These estimates were based on projected industry growth in Minnesota, projected occupation staffing of industries for the Nation, and census reports on occupational and industrial categorization of the jobs held by the population in Minnesota. Periodically, as new information becomes available (such as the 1970 Census) these estimates of occupational demand will be updated.

Using a year as the appropriate time period, occupational demand for a specific occupation can be defined as the number of positions in the occupation last year plus the average annual growth or decline in positions. In this report the estimation of occupational demand for 1971 for the nine major occupational categories in the state of Minnesota will be demonstrated.[8] These estimates are made by using data supplied by the Minnesota Department of Manpower Services already cited. They provide occupational demand estimates for 1968 and 1975 using linear projections. Average annual growth or decline can be estimated by subtracting the number of positions estimated for 1968 from the number of positions in 1975

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[7] "1975 Employment, Minnesota and Minneapolis-St. Paul Metropolitan Area and 11 Economic Regions". St. Paul, Minnesota: Minnesota Department of Manpower Services, January, 1970.

[8] Using the method described in this chapter, occupational demand estimates were made for Minnesota covering 149 occupations. See Copa, George and Donald Irwin. Occupational Demand for Minnesota in 1973. Minneapolis, Minnesota: Minnesota Research Coordinating Unit for Vocational Education, University of Minnesota, July, 1972.

and dividing by seven (the number of years between 1968 and 1975). As an example from Table 8, there were 256,469 professional positions projected for 1975 and 213,304 professional positions estimated in 1968. Subtracting 213,304 from 256,469 and dividing by seven gives the estimated average growth of 6,166 positions. In making this calculation it is assumed that occupational demand grows or declines by a constant annual amount between 1968 and 1975. This means that only general trends in occupational demand are considered; no attempt has been made to take into account year to year changes in the national, state, or local economy which may have a very specific and significant impact on yearly occupational demand. These yearly changes are also being monitored by the Minnesota Department of Manpower Services[9] and this information should be used as it becomes available in conjunction with general trend estimates. As calculated, the annual growth or decline shown in Table 8 takes into account the projected growth or decline in demand for existing firms and projected in and out-migration of firms into (and out of) Minnesota (see Figure 8 for the relationship of demand to these factors).

Estimated occupational demand for 1971 could be calculated by multiplying average annual growth or decline by three and adding this product to estimated 1968 occupational demand. However, since the 1970 Census was made between these two time periods, the Census data on the size of employment in each occupation was used to estimate demand in 1970. Using 1970 as a base year, the average annual growth or decline for each occupational group was added to derive occupational demand in 1971. The results of these calculations are shown in Table 9.

TABLE 8

Annual Growth or Decline in Occupational Demand in Minnesota 1968-1975

Occupation	1968 Demand	1975 Demand	Annual Growth or Decline
Professional	213,304	256,469	6,166
Managers	125,066	135,596	1,504
Clerical	231,120	271,466	5,764
Sales	111,359	122,202	1,549
Craftsmen	193,052	218,035	3,569
Operatives	228,543	259,004	4,352
Service	180,768	208,162	3,913
Farmers	132,696	102,226	-4,353
Laborers	50,708	49,228	- 211

[9] "Minnesota Employment Trends - A Manpower Analysis", a monthly newsletter, and a new analysis procedure being tested called "Occupational Employment Statistics Program". St. Paul, Minnesota: Minnesota Department of Manpower Service.

TABLE 9

Flow of Positions Between 1970 and 1971 for Minnesota

FROM / TO		Category in 1971									
Category in 1970	Positions in 1970[a]	Professional	Managers	Clerical	Sales	Craftsmen	Operatives	Service	Laborers	Farmers	Decline[c]
Professional	229,980	229,980									
Manager	125,904		125,904								
Clerical	252,128			252,128							
Sales	102,458				102,458						
Craftsmen	183,735					183,735					
Operatives	210,701						210,701				
Service	196,459							196,459			
Laborers	58,457								58,246		211
Farmers	104,451									100,098	4,353
Growth[b]	26,817	6,166	1,504	5,764	1,549	3,569	4,352	3,913			
Positions in 1971		236,146	127,408	257,892	104,007	187,304	215,053	200,372	58,246	100,098	4,564

[a]Source: Minnesota Analysis and Planning System, 1970 Census Date (Fourth Count), Employment Characteristics

[b]Growth includes increase in positions for existing firms and in-migration of new firms; calculated by summing all positive numbers in last column of Table 8.

[c]Decline includes decrease in positions for existing firms and out-migration of existing firms; calculated by summing all negative numbers in last column of Table 8.

SUMMARY

The information presented in Table 9 shows how occupational demand for 1971 is formulated (last row of table). The table depicts the flow of positions from 1970 to 1971 in creating occupational demand; use of this format allows analysis of sources of positions very similar to the analysis use in describing occupational supply (i.e. rate of flow from each source). In Table 9, it is assummed that there is no internal mobility of positions — for example, operative positions which are being redefined to be craftsmen positions. The estimates of demand make no implications of how demand will be filled by supply. These estimates of demand are assumed to represent the needs of Minnesota in terms of goods and services its population wants and needs. Interpretations should be tempered by more specific or timely information about any particular occupational group. The procedure used to derive an estimate of occupational demand was illustrative of the model described in Chapter 1 (Figure 8). Although there are alternative procedures, they must all contend with estimating total occupational demand and change in demand (growth or decline) between time periods. The degree of specificity with respect to occupation, time period, and geographic location will depend on how the information is to be used. Discussion of uses for planning education for work programs is presented in Chapter V.

CHAPTER IV
COMPARISON OF OCCUPATIONAL SUPPLY AND DEMAND

The first chapter of this report presented a rationale for the need for planners of education for work programs to be cognizant of both occupational supply and demand. In that chapter, a format for describing occupational supply and demand was also proposed. The second and third chapters demonstrate how occupational supply and demand, respectively, could be derived and described using the proposed format and the geographic area of Minnesota for the time period 1970-1971 as examples of place and time. This chapter will describe how occupational supply and demand can be compared and illustrate the use of the proposed format for describing supply (the flow matrix) to identify alternative means of influencing supply. Since educational planners are dealing with the supply side of the market rather than demand, occupational demand as estimated will be taken as a given. This would not necessarily be the case if one were doing overall economic planning in which one could consider alternatives that might influence both supply and demand. In the illustrated comparison, the information for Minnesota for the time period 1970-1971 will again be used as an example.

THE COMPARISON

The data on occupational supply and demand for 1971 in Minnesota is presented in Table 10. The data indicated that in 1971, supply would exceed demand by 101,687 individuals; in reality, these individuals would be unemployed. To the degree that individuals are not able to move to another occupational category (i.e. adjust to change in demand) the unemployed persons would be made up of individuals who wanted jobs as managers, clerical, craftsmen, operatives, laborers, and probably some who were already unemployed from last year. On the other hand, there will be a need for additional supply for professionals, sales, service and farmers.

The next section of this chapter will deal with the identification of alternative ways in which supply to a particular occupational group could be influenced.

ALTERNATIVE MEANS OF INFLUENCING SUPPLY

To identify the alternative means of influencing supply to a particular group, the occupational group called "service" will be used as an example. From Table 10, the data indicates an increase in supply of service workers is needed. The alternatives to increase the supply of service workers can start with an evaluation of the direct sources of service workers in the supply delivery system. This will amount to looking at the column labeled "service" in the flow matrix of Chapter II and identify the 1970 categories (rows) which contribute to the number of service workers in 1971. This data is presented in Table 11.

TABLE 10

Occupational Supply and Demand in Minnesota for 1971

Occupation	1971 Supply	1971 Demand	Net Supply - Demand
Professional	234,614	236,146	-1,532
Managers	137,926	127,408	+10,518
Clerical	262,512	257,892	+4,620
Sales	103,514	104,007	-493
Craftsmen	189,798	187,304	+2,494
Operatives	216,919	215,053	+1,866
Service	193,149	200,372	-7,223
Laborers	58,538	58,246	+292
Farmers	97,210	100,098	-2,888
Unemployed	71,780		+71,780
TOTAL	1,565,960	1,464,273	+101,687

TABLE 11

Direct Sources of Service Workers for 1971 in Minnesota

Source	Number Entering Service Worker	Number Entering Other Occupations	Number Entering Categories Other than Occupations
Secondary Education	2,201	16,851	439,939
Post Sec. College Ed.	1,962	18,241	114,997
Post Sec. Vocational Ed.	2,374	14,651	15,085
Professional	276	217,837	11,867
Managers	428	120,087	5,389
Clerical	1,336	229,790	21,002
Sales	635	92,838	8,985
Craftsmen	864	171,387	11,484
Operatives	1,938	188,177	20,586
Service	167,795	11,081	17,583
Laborers	965	50,325	7,167
Farmers	1,065	98,466	4,920
Unemployed	8,818	50,048	5,299
Military	852	15,937	32,766
Unavailable	1,640	5,317	865,945
TOTAL	193,149	1,301,033	1,583,014

Each of the categories for 1970 (rows) should be evaluated in terms of: (1) Is there a flow, (2) can the flow be increased, and (3) how much will it cost per increased individual flow into the service category. Table 11 indicates that the largest source of service workers is first those employed as service workers last year, and second those already unemployed. Other sources in order of flow from highest to lowest are post-secondary vocational school, secondary education, post-secondary college, operatives, unavailable, clerical, farmers, laborers, craftsmen, military, sales, managers, and professionals.

The column headed "number entering other occupations" represents one pool from which more flow of individuals into service worker supply could be accomplished. As stated above, the cost of moving an individual out of another occupational group and into service workers must be considered in making the judgement about where to start influencing supply of service workers. Certainly an attempt should be made to take first the individuals preparing for occupations which have an oversupply estimated. For example, one would try to influence individuals out of clerical (supply exceeds demand by 4,620) before persuading those in sales (demand exceeds supply by 493). The labor market might automatically induce this flow through wage adjustments.

The column headed "number entering categories other than occupations" represents a second pool from which more service workers could be secured. In most cases this group is further removed from supply than those entering occupational categories and so may be more difficult to secure as well as obtain immediate response. One noteable exception is the individuals who were employed as service workers in 1970 and left employment in 1971. As a temporary alternative, it may be possible to alter supply rather quickly and inexpensively by somehow encouraging these individuals not to leave. Both the cost involved in generating another service worker from each alternative source and the reaction time of each source (time required before another service worker would be available) should be considered in assessing alternative sources.

If the occupational group selected for discussion had been one in which supply exceeded demand, a table similar to Table 11 would be constructed but the objective would be to identify flows which could be altered to reduce supply to the selected occupation. This would have been the strategy if clerical had been chosen which according to Table 10 had supply exceeding demand by 4,620.

CHAPTER V
IMPLICATIONS FOR PLANNING EDUCATION FOR WORK

One of the uses of information about occupational supply and demand is in planning education for work programs. In fact, the absence of this information has often been cited as the reason for not being able to effectively plan these programs. Given the illustrative information generated in the previous three chapters, the the lack of this information is no longer as viable an excuse. Instead, it serves to raise another issue which is seemingly more important - what implications does information on occupational supply and demand have for those who plan programs directed toward education for work. What difference does it make in the plan? Perhaps educational planners need to devote at least as much time to this question as to the development of methodologies to generate occupational supply and demand information. The benefits of such efforts would be a more specific identification of the information which has use and recognition of the relative importance of this type of information as compared to other inputs into educational planning decisions.

It has already been stated that education for work programs have their major impact on the supply side of the labor market. They have impact by changing the behavioral capacity of individuals in response to the world of work. Occupational supply and demand information has implications for all five of the types of decisions which need to be made in planning educational programs, that is, for: (a) Who to serve, (b) how many to serve, (c) what to offer, (d) where to offer, and (e) when to offer.

The implications of this information on "how many" to serve is grounded in the context in which education for work programs must operate. That is, these programs have their major impact on occupational supply with occupational demand taken as a given. Second, the overall objective is to maximize the mutual satisfaction of individuals and society obtained from the work environment. The criteria of mutual satisfaction implies a need for some correspondence between occupational supply and demand - individuals cannot derive satisfaction from working if they don't have a job and society cannot derive satisfaction from the output of an employment position if the position is not filled. Third, the concept of equal educational opportunity mandates that all individuals who want to participate in education for work programs have the opportunity regardless of what occupational demand might be. Within this context, the criterion for the long run which seems most appropriate to make explicit the implications of occupational supply and demand information is the percent of total demand or supply associated with a particular occupation or occupational group. The use of a percent rather than the actual number makes explicit the philosophy that education for work programs should distribute their output according to occupational demand but should not be constrained by total demand. For example, given that all occupations are of equal value to society and if ten percent of the occupational demand was in the sales category and thirty percent for craftsman category, then the output of education for work programs should be ten percent prepared for sales

occupations and thirty percent for craftsman occupations. This criteria is independent of the information that total occupational supply may exceed, be equal to, or be less than total occupational demand.

To constrain the output of education for work programs by the amount of total occupational demand would be to deny equal educational opportunity. To allow the output to be totally independent of occupational demand could seriously reduce the possibility of maximizing the mutual satisfaction of individual and society obtained from the work world. In this context, the use of a percent as the criteria for the long run is a compromise between what may be conflicting cultural values. Obviously, the actual numbers of occupational supply and demand are also useful in planning education for work. When total supply exceeds total demand for a given geographic area, it seems appropriate that some change in demand may be necessary.

The implications of occupational supply/demand information for "who" education for work programs should serve can be described by first dividing "who" into four broad categories describing why individuals want education for work. These categories are: (a) Awareness, orientation and exploration of the world of work, (b) preparation for first job, (c) preparation for job change, and (d) preparation to keep same job. Within each of these broad categories, "what" to offer can be more specifically defined by directing implications with respect to each major occupational group (professionals, managers, clerical, etc.). Depending on the level of planning decisions being made (i.e. general to specific) the major occupational groups can be sub-divided into specific occupations. The degree of specificity needed in the description of occupational supply and demand to give valid implications in planning education for work programs will depend on the specificity of the programs being planned.

Implications for "where"and "when" decisions are based on information about the geographic location and the time of occupational demand and supply, respectively. In planning programs for different occupations, different purposes (i.e. preparation for first job vs. preparation for job change), different geographic areas (i.e. this year, next year, five years from now) it is expected that occupational demand and supply information which varies in geographic area or time would be needed. For example, when planning a program which prepares for an occupation with low density of demand and therefore, high geographic mobility requirements (i.e. furrier, geologist) state or national data may be most appropriate; whereas, for an occupation with high density of demand (i.e. secretary, truck driver), information for a county or region may be most useful.

Differences in purpose of the program must also be considered when deciding the geographic area and time of occupational supply or demand which would have the most important implications. For example, planning programs for students in grade nine and ten who are four to six years away from employment would require information about a different time period than when planning a post-secondary program whose graduates will be employed next year.

The alternatives in geographic area and time period which could be covered by occupational supply and demand information are shown in Figure 6. The decision maker must decide which combination(s) of geographic area and time period have important implications for the planning decision to be made. The information presented in this report is indicated by an "X" in the column labeled "1971" and the row labeled "state".

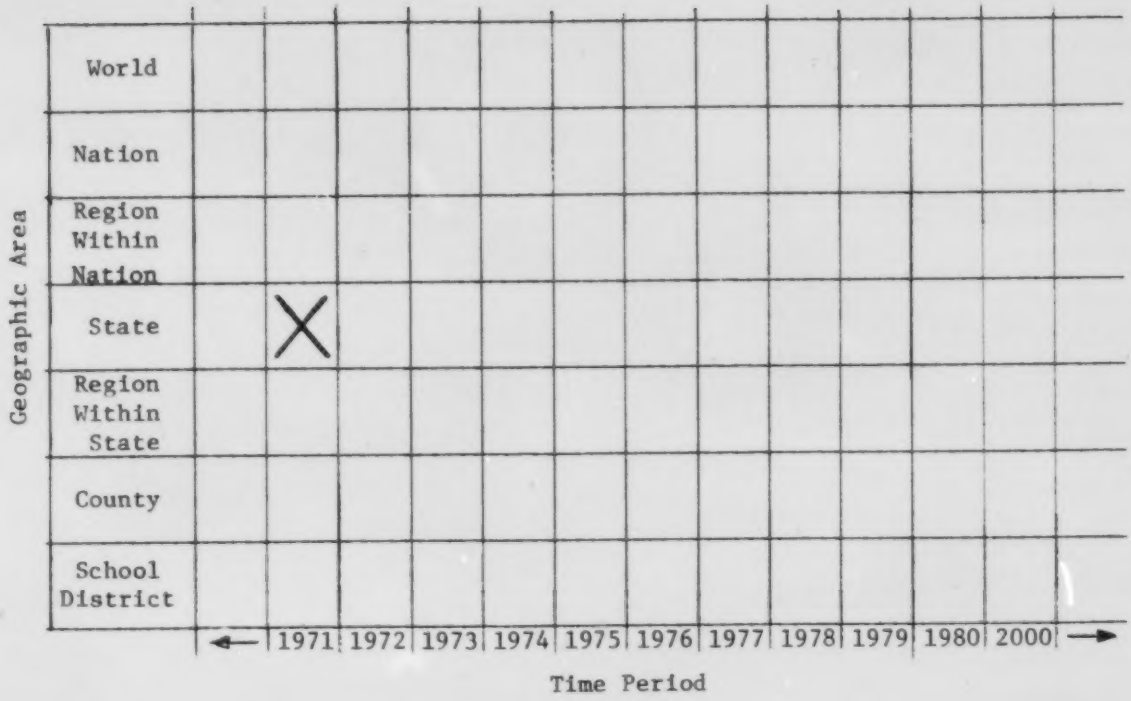

Figure 6
Alternative Configurations of Geographic Area and Time Period
Which Could be Covered by Occupational Supply and Demand Information

This chapter attempts to use the illustrative information on occupational demand and supply provided in earlier chapters in describing some of the implications of this information for planning education for work. No generalizations beyond the data should be made since the information is for only one, relatively short time period (1970-71), for a specific geographic location (Minnesota), and since the information itself varies in its accuracy because it is a first attempt and intended mainly for illustrative purposes. The intent is to identify the kinds of implications possible, especially as to their usefulness and also to review the proposed format for occupational supply and demand information as to its effectiveness in providing the information need to draw the implications, identifying alternatives if changes are to be made and assessing the likely consequences of implementing various alternatives. Further, information on occupational demand and occupational supply as derived represents only one input into the planning decisions. Information on individual demand (what are the charac-

teristics of these individuals, would they enroll if the program was offered),[10] program cost, program effectiveness, present configuration, and location of programs and available resources would also be an input to the decision process.

All implications presented below are directed at the output of education for work programs rather than inputs. Since programs may vary a great deal in cost per unit of output, final decisions about the outputs to produce and the inputs required can be made only after total resources and cost per unit of output are defined as well as the implications of many other types of information are considered. Given these considerations, the implications of occupational supply and demand information will now be described. Particularly, keep in mind that the implications are intended to be illustrative of the kind that could be made based on occupational supply/demand information. The implications per se should not be used for present policy since they are based on inadequate information (i.e. one year, only for state, contain many estimates, only for major occupational groups).

IMPLICATIONS FOR PROGRAMS DIRECTED AT AWARENESS, ORIENTATION, AND EXPLORATION

Planners of awareness, orientation, and exploration programs should initially be concerned with all occupations regardless of supply or demand. New and emerging occupations must also be treated. The objective is to make students aware of the possible work roles as well as to develop self concepts regarding their interest in and ability to perform these work roles. Later in making the individual aware of the environment surrounding various occupations, the information about occupational supply, demand, and net supply and demand becomes more important. This information becomes one input into an individual's decisions regarding his career.

Education for work programs directed at awareness, orientation, and exploration should theoretically be available for all existing as well as new and emerging occupations. Given that each occupation is as important as any other in terms of potentially being the most satisfying occupation for an individual and the one he/she is most satisfactory at performing, then an equal amount of emphasis should be given to each occupation during awareness, orientation, and exploration phases of education for work (i.e. those occupational groups having more occupations might have more time spent on them). Although it is difficult to define how many occupations there are in a particular occupational group because occupations can continually be sub-divided, one guide which could be used to allocate emphasis for awareness and orientation programs is the number of occupations included in each occupational group as reported by the Census of Population. The occupational groups, number of occupations in each group, and the percent of total occupations in a particular group as defined by the Census of Population is shown in Table 12. The percentages reported in Table 12 for each group might serve as a first approx-

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[10] See Copa, George, Edgar Persons, and Paul Thomas. Individual Demand for Vocational Education: Structure and Determination. Minneapolis, Minnesota: Minnesota Research Coordinating Unit for Vocational Education, February, 1973.

imation to a guide for output for each occupational group in awareness, orientation, and exploratory education for work programs. It may well be that this output would change if occupations were clustered according to the common characteristics which would be covered in a program directed at awareness, orientation or exploration.

TABLE 12

Number of Occupations in Major Occupational Categories

Category	*Number of Occupations	Percent of Total
Professionals	123	29%
Managers	23	5
Sales	9	2
Clerical	47	11
Craftsmen	95	23
Operatives	64	15
Service	42	10
Laborers	15	4
Farmers	6	1
TOTAL	424	100%

*Source: Alphabetical Index of Industries and Occupations, 1970 Census of Population, U.S. Department of Commerce, Bureau of Census, June, 1971.

IMPLICATIONS FOR PROGRAMS DIRECTED AT PREPARATION FOR FIRST JOB

As opposed to persons in the awareness, orientation and exploration programs who may be several years away from entering supply, the individuals enrolled in programs designed to prepare them for their first job are much closer to labor force entry. In planning these latter programs, priority must be given preparation for occupations for which there is a demand. At the marginal level (programs to be added, deleted, changed in any particular year), the information on net supply and demand becomes very relevant. It is in the decisions at this margin that an attempt must be made to relate supply and demand. However, if supply exceeds demand for all occupations, then it seems reasonable that excess supply should be spread across all occupational groups.

Planners of programs designed to prepare for first job must be very cognizant of the occupations which are entry level to occupational supply; that is, the occupations to which persons flow directly from education sources. Planners

should be very cautious about directing these programs at preparing persons for occupations which require a lot of experience to enter unless persons enrolled in the programs already have the necessary experience--they would then probably not be preparing for their first job.

For programs designed to prepare persons for their first job, it seems most appropriate to use number of unfilled entry-level positions rather than total unfilled positions as a guide for planning. The reasoning is that only the entry-level (those not requiring previous occupational experience) are available to those preparing for their first job.

From the data on supply and demand presented in Chapters II and III, respectively, and on net supply and demand as presented in Chapter IV, it is possible to derive an estimate of the percents which would meet the criterion described above (supply in each occupational group proportionate to the number of entry-level unfilled positions in the occupation group relative to total entry-level unfilled positions in all occupations). First, the expected number of unfilled positions in each occupational group can be calculated by determining the number of workers in an occupational group who leave their occupational group in a given time period (a year, 1970-1971, in this example). It is assumed that each of the workers who leaves must be replaced by hiring a new worker; this number will be referred to as replacements. The other factor to be considered is the growth or decline in demand for a particular occupational group. If there is growth, new workers must be hired; if there is decline, some of the replacement positions will not be replaced. Using this reasoning, the number of unfilled positions is a sum of the number of replacements and the growth or decline for a given time period in a particular occupational group. The derivation of the number of unfilled positions in 1971 for Minnesota is shown in Table 13.

TABLE 13

Number of Unfilled Positions in 1971 for Each Occupational Group in Minnesota

Occupational Group	Number Employed 1970	Number Still Employed in Same Occup. Group in 1971	Replace-ments	Annual Growth or Decline	Unfilled Positions
Professional	229,980	212,449	17,531	6,166	23,697
Managers	125,904	114,672	11,232	1,504	12,736
Clerical	252,128	221,950	30,178	5,764	35,942
Sales	102,458	83,125	19,333	1,549	20,882
Craftsmen	183,735	163,817	19,918	3,569	23,487
Operatives	210,701	176,799	33,902	4,352	38,254
Service	196,459	157,795	28,664	3,913	32,577
Laborers	58,457	43,187	15,270	-211	15,059
Farmers	104,451	92,157	12,294	-4,353	7,941
TOTAL	1,464,273	1,275,951	188,322	22,253	210,575

Given the calculation of total unfilled positions, the next step is to derive an estimate of the number of these positions which are entry-level. It can be reasoned that the unfilled positions which are filled by internal mobility (the movement of experienced workers) represent non-entry level positions. With this logic, the number of entry-level unfilled positions can be calculated by subtracting the number of positions in a particular occupation group which are filled by internal labor mobility. This information is available from the data presented in Chapter II and Appendix I. The calculations are shown in Table 14.

Table 14

Number of Entry-Level Unfilled Positions for Minnesota

Occupational Group	Total Unfilled Positions	Positions Filled by Internal Mobility	Number of Entry-Level Unfilled Positions	Percent of Total
Professional	23,697	6,107	17,590	13%
Managers	12,736	10,031	2,705	2
Clerical	35,942	9,737	26,205	20
Sales	20,882	5,659	15,223	12
Craftsmen	23,487	11,125	12,362	9
Operatives	38,254	19,012	19,242	15
Service	32,577	7,507	25,070	19
Laborers	15,059	8,825	6,234	5
Farmers	7,941	1,330	6,611	5
TOTAL	210,575	79,333	131,242	100%

The last column in Table 14 represents the percent of total entry level positions available in each occupational group. This percentage could be used as an indicator of how supply from education for work programs directed at entry-level preparation could be proportioned among occupational groups. This calculation assumes no concern for the supply available from the unemployed, military, and those presently unavailable for work. Note that the emphasis here, as in the other implications presented in this chapter, is in terms of output of education for work programs not in terms of inputs. A decision about input allocation would depend on the cost of the various programs.

In summary, the information on occupational supply and demand has very direct implications for education for work programs directed at entry level work preparation. The implications are made explicit by stating that occupational supply from these programs should be proportioned by occupational group to the number of entry-level positions available in each occupational group. This criteria assumes that all occupations are equally important to society and potentially satisfying to some individuals. It treats occupations equally in either the situation where supply exceeds demand (as illustrated) or when demand exceeds supply. To the degree that this criteria is not met by the present output of education for work programs directed at entry-level preparation, marginal changes in programs may be appropriate.

IMPLICATIONS FOR PROGRAMS DIRECTED AT PREPARATION FOR JOB CHANGE

Education for work programs designed to prepare persons for job change are often also called upgrading and retraining programs. Planners of these programs should be sensitive to the internal labor mobility of those already employed as well as those who are unemployed or unavailable and had been employed at some time in the past. Education for work programs directed at job change can satisfy both the constant need for individuals to move "up" in their work careers as well as the need by some individuals to pursue a different occupation (horizontally across occupations rather than vertically within related occupations) because of a change in interest or because of potential or actual unemployment as a result of an oversupply of workers in the occupation for which they are presently prepared.

The implications of information on occupational demand and supply as well as net demand and supply are of particular importance to planners of education for work programs directed at preparation for job change. First, these programs make it easier for persons to move into occupations which require previous occupational experience. Many of these occupations are managerial in nature and important to the health of the industrial economy. Second, these programs are often used as a primary mode of reducing unemployment caused by net occupational supply in one occupation relative to another. The objective here is to retrain persons from occupations having net supply to those having net demand or proportionately less net supply. Third, these programs constitute the means to change to a new, unrelated occupation. In meeting the needs of this change, these programs help to satisfy individuals who may have chosen unsatisfactory occupations for themselves initially or whose desired occupation changed over time.

Programs directed at preparing individuals to take different jobs should take guidance from the opportunity for making job change for each occupational group. One indicator of this opportunity is the internal mobility of individuals making up occupational supply. These individuals have moved because there was a position available to them. From the data in Chapter II, an estimate can be made of the opportunity for job change by assessing the number of individuals who were employed in 1970 but switched occupational groups in 1971. These numbers are shown in Table 15.

Programs of education for work directed at preparation for job change might well be guided in their planning by the number of opportunities for workers with previous experience. These workers would include persons who want to advance, those moving to a new unrelated occupation, and those who were employed but are now unemployed or unavailable for work and wish employment in a different occupation. Information on internal labor mobility of workers is one indicator of unfilled positions available for experienced workers. The output of education for work programs with the above purpose might well be proportioned by occupation to the number of opportunities in the given occupation as a proportion of total opportunities. The last column in Table 15 is one attempt at deriving a guide of this nature.

TABLE 15

Number of Positions Filled by Job Changers in 1971 for Minnesota

Occupational Group	Positions in Occupational Group Filled by Internal Mobility	Percent of Total
Professional	6,107	8%
Managers	10,031	13
Clerical	9,737	12
Sales	5,659	7
Craftsmen	11,125	14
Operatives	19,012	24
Service	7,507	9
Laborers	8,825	11
Farmers	1,330	2
TOTAL	79,333	100%

IMPLICATIONS FOR PROGRAMS DIRECTED AT PREPARATION TO KEEP SAME JOB

Education for work programs directed at preparation to keep the same job are often also called updating programs. Planners of these programs must be aware of the size of the group of individuals who wish to stay at their same job each year and of technological change. Even for individuals who want to stay at the same job, it will be necessary to keep themselves updated. The size of this group and the degree of technological change in a particular occupation have direct implications for those programs. This group is made up of all those who are employed and wish to stay at the same job as well as the unemployed and those who are unavailable for work who wish to re-enter the same occupation they had previously. In planning to reduce net supply or demand the existence of this program can influence the number of individuals leaving or staying in an occupation. In general, for those who leave supply temporarily, their skills must be updated if they are to re-enter supply at a later time. This is another way that these programs can have implications from net supply or demand information (i.e. they can be used to increase supply rather quickly by updating persons who are unemployed or who would be available for employment if they were updated).

The number of positions available to those who wish to stay at the same occupation is one logical guide in planning the scope and occupational distribution of education for work programs directed at preparing persons to keep the same job. Using only this criterion assumes that the rate of technological change is the same in each occupation--which is not as true as the statement that all occupations are experiencing some technological change for which workers must be prepared if they are to stay in the same occupation.

An estimate of the number of positions available to those wishing to stay in the same occupation can be derived by again looking at internal mobility and focusing on the number of workers who stay at the same job. This information can be taken from the data on occupational supply described in Chapter II and Appendix I. It is presented in Table 16.

Again, a reasonable strategy would be to plan education for work programs with the above purpose such that their output for supply to each occupation is proportionate to the number of positions available for those who wish to remain at the same occupation relative to the total positions of this kind available for all occupations. An indicator of these proportions is the percentages presented in the last column of Table 16.

TABLE 16

Number of Positions Filled by Individuals Keeping Same Job in 1971 for Minnesota

Occupational Group	Positions in Occupational Group Filled by Those Staying in Same Group	Percent of Total
Professional	212,449	17%
Managers	114,672	9
Clerical	221,950	17
Sales	83,125	7
Craftsmen	163,817	13
Operatives	176,799	14
Service	167,795	13
Laborers	43,187	3
Farmers	92,157	7
TOTAL	1,275,951	100%

COMPARISON OF IMPLICATIONS FOR PROGRAMS DIRECTED AT EDUCATION FOR WORK

Up to this point, the implications for programs directed at education for work resulting from occupational demand and supply information have been provided separately for each of four broad categories based on purpose and who the programs serve; these categories were: (a) Awareness, orientation, and exploration, (b) preparation for first job, (c) preparation for job change and (d) preparation to keep same job. The implications of information on occupational supply and demand for each of these groups of programs was given as a guide indicating the output emphasis which might be given to each major occupational group. This guide was to serve as one input into decisions regarding the distribution of effort among occupational groups for programs having a common purpose. The guides indicate the percent of total output for each type of education for work program which should be related to each occupational group. The percent distribution for each program type for each occupational group is shown in Table 17.

TABLE 17

Guideline for Distribution of Effort Among Occupational Groups by Education for Work Programs as Implied by Occupational Supply/Demand Information for 1971 in Minnesota

Occupational Group	Awareness Orientation Exploration	Preparation for First Job	Preparation for Job Change	Preparation to Keep Same Job
Professional	29%	13%	8%	17%
Managers	5	2	13	9
Clerical	11	20	12	17
Sales	2	12	7	7
Craftsmen	23	9	14	13
Operatives	15	15	24	14
Service	10	19	9	13
Laborers	4	5	11	3
Farmers	1	5	2	7
TOTAL	100%	100%	100%	100%

In reviewing Table 17, it should be noted that the distribution of effort for occupational groups is quite different for each type of education for work program.

For example, service occupations are ranked second in terms of educational need compared to other occupational areas when considering programs preparing for a first job but ranked sixth in terms of need for programs directed at preparation for job change as implied by occupational supply and demand information. Care must be taken in making comparisons across program areas since the numbers in Table 17 are percentages derived from different base numbers. The focus should be on the variation in ranking of occupational groups from one program purpose to another.

Another way of summarizing the implications of occupational supply and demand information for education for work programs is in terms of its meaning for the distribution of total effort among the programs grouped by purpose. Assuming that each individual is equal to every other individual and that every occupation is as important as every other occupation, then some implications can be drawn. These implications could be made explicit by assessing the total number of individuals seeking each type of program. An estimate of this total can be made by using the information on supply as an indicator of need for various programs.

Awareness, orientation, and exploration programs are most appropriate for individuals in elementary and secondary school programs. Using the data from Chapter II, there are expected to be 480,976 individuals in these programs in 1971. Education for work programs directed at preparation for first job includes those expected to be in post-secondary college and vocational programs as well as those leaving secondary education and becoming employed or unemployed in 1971. According to the tables in Chapter II, these individuals make up a group of 174,107 persons.

The number of individuals seeking programs directed at preparation for job change can be estimated from the number who changed jobs between 1970 and 1971. This number is 79,333. The number seeking programs directed at preparation to keep the same job can in a similar way be estimated by the number who remained in the same job - both those who were employed or unemployed in the previous year (1970). This number is 1,275,951 employed plus 58,864 unemployed for a total of 1,334,815.

The data about demand for each type of education for work is summarized in Table 18 from each of the previous four tables. Assuming that the program types are all of equal importance to society and individuals, the last column of Table 18, indicating percent of total demand represented by each of the program types, might be used as one input into deciding the amount of output which needs to be produced by each group of education for work programs. The amount of resources required for each group can only be assigned after knowing the cost per unit of output which needs to be produced by each group of education for work programs.

TABLE 18

Guideline for Distribution of Output Among Education for Work Programs as Implied by Occupational Supply/Demand Information for 1971 in Minnesota

Program Type	Number Seeking	Percent of Total
Awareness, Orientation, Exploration	478,511	23%
Preparation for First Job	174,107	8
Preparation for Job Change	79,333	4
Preparation to Keep Same Job	1,334,815	65
	2,069,231	100%

SUMMARY

Decision makers given the responsibility of planning educational programs designed to prepare persons for work must be aware of occupational supply and demand. Awareness of these two concepts and the forces affecting them provides one input to decisions which can help insure that both the needs of individuals and society are fulfilled through educational programs. In this report, a format for describing and deriving an estimate of occupational supply and demand has been presented. Second, a demonstration of how occupational supply and demand for a particular time period (1970-71) and geographic area (Minnesota) could be determined using the proposed format was described. Last, a set of implications of this information for planners of education for work programs was made explicit. The implications were directed at the types of decisions educational planners have to make - who, how many, what, when, and where. However, the implications are only illustrative since they were based on occupational supply and demand information from one time period, one geographic area, and then only for broad categories of occupations. The purpose of the illustrative implications was to serve as a basis for discussion concerning the usefulness of occupational supply and demand information in planning education for work programs. An initial premise was that this aspect of planning education for work programs and constructing the necessary supporting management information system has not been given adequate consideration.

If the illustrative implications for planning education for work programs based on occupational supply and demand information are found to be useful, then the next step might be to test if the proposed format for occupational supply and demand information can be filled in with valid data for various geographic areas

(i.e. state, economic region, county) and time periods. Although the implications presented in this report were directed at the state level, implications in the same format could be generated for small areas and specific occupations by deriving occupational and supply and demand information using the same format but in much more geographic and occupational detail. The demonstration of filling in the proposed format with data as described in this report was a preliminary step - many sources of data were identified and their accuracy reviewed; many data gaps also became evident and were also identified. When a valid set of data can be placed in the proposed format for a series of time periods, then as assessment should be made of the predictability of individual and position flow over time periods. Predictability of these flows from one time to another will be necessary if the implications drawn for planning educational programs are to be valid for future periods covered by the plan.

As a final point, the proposed format was designed to identify and allow testing of alternative strategies for altering either supply or demand or both through changes in education for work programs recognizing that educational programs have their primary effect on supply and are only one of several means of altering supply and demand. This ability to realistically test alternatives representing various potential policy decisions and then to observe their consequences before actual implementation is an "edge" the educational planner and policy maker needs given the complexity of our society.

APPENDIX I

Occupational Supply Flow Matrix
for Minnesota, 1970-1971

TABLE 1

Occupational Supply Flow Matrix for Minnesota, 1970-1971

Category	1970 \ 1971	Pre-School		Elementary		Secondary		Post Sec. College		Post Sec. Vocational		Employed	
		Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
Birth	66,448	65,252	98.20										
Pre-School	265,323	195,013	73.50	70,045	26.40								
Elementary	584,087			496,240	84.96	87,613	15.00						
Secondary	458,991					393,363	85.71	22,691	4.95	9,330	2.04	19,052	4.15
Post Sec. College	135,200							106,849	79.03	2,548	1.88	20,203	14.94
Post Sec. Vocational	32,110							276	.86	8,526	26.55	17,025	53.02
Employed	1,464,273											1,355,290	92.56
Professional	229,980											218,113	94.84
Manager	125,904											120,515	95.72
Clerical	252,128											231,126	91.67
Sales	102,458											93,473	91.23
Craftsmen	183,735											172,251	93.75
Operative	210,701											190,115	90.23
Service	196,459											178,876	91.05
Labor	58,457											51,290	87.74
Farm	104,451											99,531	95.29
Unemployed	64,163											58,864	91.74
Military	49,555							1,716	3.47	816	1.65	16,789	33.88
Unavailable	872,902											6,957	.80
TOTAL	3,993,052	260,265	6.52	566,285	14.18	480,976	12.05	131,532	3.29	21,220	.53	1,494,180	37.42

Category	Professional		Manager		Clerical		Sales		Craftsmen		Operative	
	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
Birth												
Pre-School												
Elementary												
Secondary	--	--	--	--	8,682	1.90	4,417	.97	1,802	.40	234	.05
Post Sec. College	5,574	4.12	5,125	3.79	3,006	2.22	2,539	1.88	1,075	.80	615	.45
Post Sec. Vocational	3,722	11.59	--	--	7,430	23.14	1,230	3.83	1,528	4.76	508	1.58
Employed	218,556	19.23	124,703	8.52	231,693	15.82	88,784	6.06	174,942	11.95	195,811	13.37
Professional	212,449	92.38	1,587	.69	1,702	.74	713	.31	552	.24	397	.17
Manager	1,083	.86	114,672	91.08	995	.79	932	.74	869	.69	1,183	.94
Clerical	1,790	.71	958	.38	221,950	88.03	1,084	.43	1,185	.47	2,067	.82
Sales	492	.48	2,613	2.55	1,783	1.74	83,125	81.13	748	.73	3,770	3.68
Craftsmen	974	.53	1,672	.91	919	.50	588	.32	163,817	89.16	1,837	1.00
Operative	590	.28	1,011	.48	2,065	.98	632	.30	4,067	1.93	176,799	83.91
Service	707	.36	1,513	.77	1,631	.83	1,100	.56	1,002	.51	3,831	1.95
Labor	398	.68	228	.39	491	.84	286	.49	1,783	3.05	3,765	6.44
Farm	73	.07	449	.43	157	.15	324	.31	919	.88	2,162	2.07
Unemployed	3,920	6.11	5,346	8.33	8,576	13.37	4,279	6.67	6,682	10.41	14,815	23.09
Military	1,685	3.40	2,517	5.08	738	1.49	1,754	3.54	3,662	7.39	4,189	8.45
Unavailable	1,157	.13	235	.03	2,387	.27	511	.06	107	.01	747	.09
TOTAL	234,614	5.88	137,926	3.45	262,512	6.57	103,514	2.59	189,798	4.75	216,919	5.43

Category	Service		Labor		Farm		Unemployed		Military		Unavailable	
	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
Birth											1,196	1.80
Pre-School											265	.10
Elementary											234	.04
Secondary	2,201	.48	633	.14	1,083	.24	2,303	.51	4,546	.99	7,706	1.68
Post Sec. College	1,962	1.45	307	.23	--	--	3,760	2.78	1,701	1.26	139	.10
Post Sec. Vocational	2,374	7.39	--	--	233	.73	1,794	5.59	2,639	8.22	1,850	5.76
Employed	175,302	11.97	52,012	3.55	93,487	6.38	60,257	4.12	5,228	.36	43,498	2.97
Professional	276	.12	437	.19	--	--	4,439	1.93	644	.28	6,784	2.95
Manager	428	.34	252	.20	101	.08	1,573	1.25	339	.27	3,477	2.76
Clerical	1,336	.53	605	.24	151	.06	10,135	4.02	378	.15	10,489	4.16
Sales	635	.62	174	.17	133	.13	4,375	4.27	850	.83	3,760	3.67
Craftsmen	864	.47	1,176	.64	404	.22	6,853	3.73	1,011	.55	3,620	1.97
Operative	1,938	.92	2,718	1.29	295	.14	14,665	6.96	1,117	.53	4,804	2.28
Service	167,795	85.41	1,238	.63	59	.03	10,393	5.29	196	.10	6,994	3.56
Labor	965	1.65	43,187	73.88	187	.32	5,735	9.81	421	.72	1,011	1.73
Farm	1,065	1.02	2,225	2.13	92,157	88.23	2,089	2.00	272	.26	2,559	2.45
Unemployed	8,818	13.74	4,332	6.75	2,096	3.27	3,458	5.39	--	--	1,841	2.87
Military	852	1.72	1,184	2.39	208	.42	208	.42	30,026	60.59	--	--
Unavailable	1,640	.19	70	.01	103	.01	--	--	--	--	865,945	99.20
TOTAL	193,149	4.84	58,538	1.47	97,210	2.43	71,780	1.80	44,140	1.11	922,674	23.11

APPENDIX II

Description of Flow of Individuals
With Respect to Occupational Supply
for Minnesota, 1970-71

DESCRIPTION OF FLOW OF INDIVIDUALS WITH RESPECT TO OCCUPATIONAL SUPPLY FOR MINNESOTA, 1970-71

The flow of individuals between and within categories from 1970 to 1971 in Minnesota will be presented in this section. The description of the complete flow matrix will be described in parts by selecting several related categories of individuals in 1970 (i.e. those in the Birth and Pre-School categories) and showing the estimated distribution of individuals in the selected categories in terms of all categories in 1971 (i.e. the category which describes the individual's status in 1971). In effect the procedure is to select a set of rows (1970 categories) and present the distribution of individuals in these categories in terms of each column (1971 categories). For each column, both the number and percent of the total number in a given row are indicated. It should be recognized that all numbers and percentages are estimates based on identified sources of information. Estimates vary in validity from very accurate to out-right guesses. The authors again implore the reader to exercize extreme caution in interpreting the numbers and percentages contained in this publication.

UNDER SCHOOL AGE

The flow of individuals under school age is summarized in Table 1. These individuals are unavailable for work and therefore have no direct influence on supply. However, these categories are the starting points in the delivery system for supply and will have an influence on what happens in the future.

TABLE 3

Under School Age in 1970 by Category in 1971

1970 \ 1971		Pre-School		Elementary		Other Categories		Unavailable, Other	
Category	Total Number	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Birth	66,448	65,252	98.2					1,196	1.80
Pre-School	265,323	195,013	73.5	70,045	26.4			265	.10

The birth row in Table 1 includes all individuals born between January 1 and December 31 of 1970. The pre-school row includes all individuals born before January 1, 1970, who are under the age of five years as of that date. The column headed "total number" indicates the total number of individuals in the respective rows in 1970. As shown and as also indicated in Chapter I (Table 1), the estimated total number of births in 1970 was 66,448 and the number of individuals in pre-school was 265,323. The remaining columns indicate the number and percentage of the 1970 total number who moved to the categories given in the column headings for 1971. As shown in Table 1, 65,252 individuals or 98.2% of the total births during 1970 entered the pre-school category in 1971 (10). No individuals in the birth category entered the elementary category or any other categories, except the unavailable category in 1971. The 1,196 individuals classified as unavailable were the estimated number of individuals from this classification who died during 1970. This estimate was based on age specific death rates (11). Of the 265,323 individuals who were classified pre-school in 1970, 195,013 remained in this classification in 1971 (12). As is also indicated in Table 1, an estimated 70,045 individuals changed from pre-school to elementary classifications in 1971. This estimate was arrived at by assuming that all individuals reaching age five during 1970 would start school in grade K in 1971 (13). As was the case with the birth category, an age specific death rate was estimated for the pre-school individuals. The estimate resulted in 265 deaths shown in the unavailable category of 1971 from the total number of pre-school individuals in 1970 (14).

Table 1, therefore, shows the flow of individuals between and within categories between January 1, 1970, and January 1, 1971. The categories used to name the table are the 1970 or row categories. This naming procedure will be followed in the remaining tables of this report. In the text explaining the table, the numbers in parentheses correspond to footnotes located in Appendix III, which more specifically describes how the numeric estimates of numbers and percentages were made.

ELEMENTARY AND SECONDARY EDUCATION

The flow of individuals through the elementary and secondary education categories is shown in Table 2. These categories represent the "compulsory" stage of education. The elementary category is comprised of the individuals enrolled in grades K through 6 and the secondary category is comprised of those individuals enrolled in grades 7 through 12. As shown in the total number column of Table 2, there were 584,087 and 458,991 individuals in these respective categories during the school year from September 1969 to June 1970.

Of the individuals enrolled in elementary school in 1970, a total of 496,240 individuals or eighty-five percent (15) were in elementary school in 1971, and fifteen percent moved to the secondary category in 1971 (16). This latter percentage represents the number of individuals in the sixth grade in 1970. Since no information concerning retention was found, it was assumed that these sixth grade students all advanced to grade seven in 1971.

TABLE 2

Elementary and Secondary Education Categories in 1970
by Non-Supply Category in 1971

1970	1971	Elementary		Secondary		Post-Sec. College		Post-Sec. Vocational		Military		Unavailable	
Category	Total Number	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Elementary	584,087	496,240	84.96	87,613	15.00							234	.04
Secondary	458,991			393,363	85.71	22,691	4.95	9,330	2.04	4,546	.99	7,706	1.68

As previously stated, 458,991 individuals were categorized in the secondary category in 1970. Of these 458,991 people, 85.7% or 393,363 people remained in the secondary category in 1971 (17).

The individuals classified as elementary and secondary in 1970 can also flow into post-secondary education categories in 1971. As shown in Table 2, 22,691 (4.95%) of the individuals classified in the secondary education category in 1970 entered post-secondary education in the college category in 1971 (18). At the same time, 9,330 (2.04%) entered the post-secondary vocational school category in 1971 (19). An estimate of those individuals in the secondary category in 1970 entering the military in 1971 is also shown in Table 2 (20) as is an estimate of those people from this category who were unavailable in 1971 (21).

The estimated flow of individuals from elementary and secondary education categories in 1970 to categories which influence occupational supply in 1971 is presented in Table 3. For the 1970 elementary category this flow is zero for all 1971 categories. Unlike the elementary category, however, the flow of individuals from the secondary category does affect supply. As previously defined, supply consists of those individuals who are either employed or unemployed (those available for employment).

The employed category for 1971 is subdivided into nine categories in Table 3. It was assumed, due to the nature of the jobs in the professional and managers categories, that those individuals with only a high school education would not enter these categories in any significant number. Therefore, the remaining seven categories represent the major employment area open to secondary education graduates (22).

As shown in Table 3, a major portion of those individuals who flow into employment from the secondary education category enter in the clerical category. The flow into the other employed categories is as follows, ranked by number of entrants: sales, service, craftsmen, farmers, laborers and operatives.

Also shown in Table 3 is an estimate of the number of individuals who were in the secondary category in 1970 and in the unemployed category in 1971. This estimate is that 2,303 or .5% of the individuals in secondary school during 1970 became unemployed in 1971 (23).

TABLE 3

Elementary and Secondary Education Category in 1970 by Supply Category in 1971

1970 \ 1971		Employed As:									
		Professional		Manager		Clerical		Sales		Craftsmen	
Category	Total Number	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Elementary	579,017										
Secondary	458,991	—	—	—	—	8,682	1.90	4,417	.97	1,802	.40

1970 \ 1971	Employed As:								Unemployed	
	Operatives		Service		Laborers		Farmers			
Category	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Elementary										
Secondary	234	.05	2,201	.48	633	.14	1,083	.24	2,303	.51

POST-SECONDARY EDUCATION

The next group of categories within the supply delivery system is that of post-secondary education. The number in each of these categories as of 1970 and their distribution in categories not a part of occupational supply in 1971 is shown in Table 4.

TABLE 4

Post Secondary Education Categories in 1970
by Post Secondary Non-Supply Categories in 1971

1970	1971	Post-Sec. College		Post-Sec. Vocational		Military		Unavailable	
Category	Total Number	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Post-Secondary College	135,200	106,849	79.03	2,548	1.88	1,701	1.26	139	.10
Post-Secondary Vocational	32,110	276	.86	8,526	26.55	2,639	8.22	1,850	5.76

As previously stated, the 1971 categories shown in Table 4 are non-supply categories and the individuals assigned to these categories have no direct effect on the supply of individuals for work. However, these categories do represent important steps in the supply delivery system because the individuals who flow from these categories may eventually become a part of supply.

Existing data concerning the 1971 distribution of the 135,200 individuals enrolled in four year colleges and two year colleges indicated that about 79% remained in this same category in 1971 (24). At the same time about 1.9% of this group entered either public or private vocational schools in the State and MDTA programs (25). As can be seen in Table 4, it was estimated that about 1.3% of the individuals in this category in 1970 entered the military in 1971 (26) and about .1% were classified unavailable (27).

It was estimated, from existing data, that about 26.5% of the 1970 post-secondary vocational school enrollment remained in this category in 1971 (28). During the same period, about .9% entered either two year or four year colleges (29) while 8.2% entered the military category (30). As shown in Table 4, the remaining 5.8% were classified as unavailable (31).

A portion of those individuals enrolled in post-secondary education categories during 1970 also enter employed and unemployed categories in 1971, both of which directly effect the supply of individuals available for work. The 1971 distribution of these individuals within the categories of employed and unemployed is shown in Table 4.

TABLE 5

Post Secondary Education Category in 1970 by Supply Category in 1971

1970 \ 1971		Employed As:									
		Professional		Manager		Clerical		Sales		Craftsmen	
Category	Total Number	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Post-Secondary College	135,200	5,574	4.12	5,125	3.79	3,006	2.22	2,539	1.88	1,075	.80
Post-Secondary Vocational	32,110	3,722	11.59	0	0	7,430	23.14	1,230	3.83	1,528	4.76

1970 \ 1971	Employed As:								Unemployed	
	Operative		Service		Labor		Farm			
Category	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Post-Secondary College	615	.16	1,962	1.45	307	.23	0	0	3,760	2.78
Post-Secondary Vocational	508	1.58	2,374	7.39	0	0	233	.73	1,794	5.59

The 1971 distribution of the people in each category of the 1970 post secondary education categories is also shown in Table 5. For example, from Table 5, about 4.1 and 3.8% of those individuals in the post secondary college category in 1970 became employed in the professional and manager categories, respectively, in 1971. In addition, 2.2 or about 3,006 individuals entered the 1971 clerical category, 1.9% or about 2,539 individuals entered the 1971 sales category and 1.4% or about 1,962 people entered the 1971 service category. Smaller numbers entered the craftsmen, operative, and laborer categories. During the smae time period about 3,760 or 2.8% of the individuals in the 1970 post secondary category were classified as unemployed in 1971 (32).

The 1971 distribution of those individuals in the post secondary vocational education category during 1970 is also given in Table 5. Of people from this category who became employed, the largest number, 7,430 or 23.1% entered the 1971 clerical category followed by about 3,722 or 11.6% who entered the 1971 professional category. The distribution of individuals from the 1970 post secondary vocational education category into the 1971 service, craftsmen, and sales categories was estimated to be 2,374 people, 7.4%, 1,528 people, 4.8%, and 1,230 people, 3.8%, respectively. The remaining people who entered the 1971 supply categories were estimated to be as follows: 508 people, 1.5% operatives; 233 people, .7% farmers; and 1,794 people, 5.6% unemployed (33).

EMPLOYED

The largest single category of the supply delivery system is composed of those individuals employed in the civilian labor force. This number, 1,464,273 employed people in 1970, represents 36.7% of the total 1970 population of Minnesota. The number of employed people in 1970 by occupation category and their distribution by supply category in 1971 is presented in Table 6 (34).

For those individuals who remained in the supply categories between 1970 and 1971, two phenomena can take place: (1) internal labor mobility, employed individuals in 1970 remaining employed in 1971 but changing occuaptional category and (2) employed individuals staying in the same occupational category in 1971 as in 1970. As an example of internal mobility, refer to the professional row in Table 6. The "total number" column indicates 229,980 individuals were employed as professional in 1970. One part of internal mobility for professionals in defined by the movement of professionals in 1970 to a different occupational category in 1971. For example, of the 229,980 individuals who were professionals in 1970, 1,587 (.69%) became managers and 1,702 (.74%) became clerical in 1971. The professional category in 1971 shows that 94.8% of the professionals in 1970 remained professionals in 1971; although not shown in Table 6, there could also be internal mobility even within the professional occupations (i.e. electrical engineer in 1970 to aeronautical engineer in 1971). Another part of internal mobility affecting the professional category in 1971 (column) is the movement of individuals in other occupational categories in

TABLE 6

Employed Category in 1970 by Supply Category in 1971

1970 / 1971		Professional		Manager		Clerical		Sales		Craftsmen	
Category	Total Number	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Professional	229,980	212,449	92.38	1,587	.69	1,702	.74	713	.31	552	.24
Managers	125,904	1,083	.86	114,672	91.08	995	.79	932	.74	869	.69
Clerical	252,128	1,790	.71	958	.38	221,950	88.03	1,084	.43	1,185	.47
Sales	102,458	492	.48	2,613	2.55	1,783	1.74	83,125	81.13	748	.73
Craftsmen	183,735	974	.53	1,672	.91	919	.50	588	.32	163,817	89.16
Operatives	210,701	590	.28	1,011	.48	2,065	.98	632	.30	4,067	1.93
Service	196,459	707	.36	1,513	.77	1,631	.83	1,100	.56	1,002	.51
Laborers	58,457	398	.68	228	.39	491	.84	286	.49	1,783	3.05
Farmers	104,451	73	.07	449	.43	157	.15	324	.31	919	.88

1970 / 1971	Operative		Service		Farm		Labor		Unemployed	
Category	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Professional	397	.17	276	.12	0	0	437	.19	4,439	1.93
Managers	1,183	.94	428	.34	101	.08	252	.20	1,573	1.25
Clerical	2,067	.82	1,336	.53	151	.06	605	.24	10,135	4.02
Sales	3,770	3.68	635	.62	133	.13	174	.17	4,375	4.27
Craftsmen	1,837	1.00	864	.47	404	.22	1,176	.64	6,853	3.73
Operatives	176,799	83.91	1,938	.92	295	.14	2,718	1.29	14,665	6.96
Service	3,831	1.95	167,795	85.41	59	.03	1,238	.63	10,393	5.29
Laborers	3,765	6.44	965	1.65	187	.32	43,187	73.87	5,735	9.81
Farmers	2,162	2.07	1,065	1.02	92,157	88.23	2,225	2.13	2,089	2.00

1970 into the professional category in 1971. For example, in the second row of Table 6, 1,083 individuals who were managers in 1970 were professionals in 1971. Implications of internal mobility for supply and education for work were discussed in an earlier section of this report.

The magnitude of the flow of individuals from the employed category in 1970 to the unemployed category in 1971 is indicated in the last column of Table 6 (35). As previously mentioned, this change in categories does not effect the overall supply pool because these people were still considered available to fill jobs created by demand.

In addition to the movement within the supply categories, individuals classified as employed in 1970 may also enter non-supply categories in 1971. The estimated distribution of these employed people into non-supply categories in 1971 is presented in Table 7.

Table 7

Employed Category in 1970 by Non-Supply Category in 1971

1970	1971	All Education Categories		Military		Unavailable	
Category	Total Number	Number	Percent	Number	Percent	Number	Percent
Professional	229,980	0	0	644	.28	6,784	2.95
Managers	125,904	0	0	339	.27	3,477	2.76
Clerical	252,128	0	0	378	.15	10,489	4.16
Sales	102,458	0	0	850	.83	3,760	3.67
Craftsmen	183,735	0	0	1,011	.55	3,620	1.97
Operatives	210,701	0	0	1,117	.53	4,804	2.28
Service	196,459	0	0	196	.10	6,994	3.56
Laborers	58,457	0	0	421	.72	1,011	1.73
Farmers	104,451	0	0	272	.26	2,559	2.45

As seen in Table 7, the flow of individuals from employed categories in 1970 to non-supply education categories in 1971 was assumed to be zero for all categories because of lack of data on flow of employed individuals. The assumption may not error too widely when the education categories are defined as containing only those individuals attending school full time.

The military column in Table 7 indicates the estimated number of employed individuals in 1970 who enter the military service in 1971 for each of the nine occupation categories. These estimates were based on a study of Air Force personnel; the assumption was made that these percentages are applicable to all military services (36).

The remaining non-supply category shown in Table 7 is unavailable. This column indicates the number of people who were employed in 1970 but not available to the labor force in 1971. The unavailable category includes those people who die, retire, leave the labor force for reasons other than those already categorized, and people who were not categorized in other categories due to lack of data (37).

UNEMPLOYED

The estimated number of unemployed individuals in 1970 and their 1971 distribution is shown in Table 8. At the time of this report no data was found to allow estimation of the number, if any, of unemployed individuals entering either the education or military categories. It was therefore assumed that the proportion entering these categories from the unemployed category was zero.

TABLE 8

Unemployed Category in 1970 by Supply & Non-Supply Category in 1971

1971 / 1970		Education		Military		Employed		Unemployed		Unavailable	
Category	Total Number										
Unemployed	64,163	0	0	0	0	58,864	91.74	3,458	5.39	1,841	2.87

The employed category of Table 8 presents the number and percentage of individuals in the unemployed category in 1970 who became employed in 1971. It should be noted that the numbers and percentages presented in this column are based on the assumption that unemployed people who enter the labor force in 1971 enter in the same occupational category they were in in 1970. The number of unemployed persons who remain unemployed as shown in Table 8 is based on an estimate of the number of persons who remain unemployed for more than 27 weeks per year. The final column of Table 8, unavailable, indicates the estimated number of individuals who were unemployed in 1970 and were unavailable to the labor force in 1971 due to death, retirement, leaving the labor force for other reasons or people not classified in categories due to lack of data (38).

MILITARY

An estimate of the number of individuals in the military category in 1970 and their occupational distribution in 1971 is shown in Table 9. Existing data from Minnesota selective services indicated that 49,555 people, about 1.3% of the population were in the military services in 1970. As shown in Table 9, about 3.5% of these people left the military and entered the college level of education in 1971 while about 1.65% entered post-secondary vocational level of education (39). Also, as shown in the employed column of Table 9, approximately 33.5% of the people in the military in 1970 became employed in 1971. The occupational distribution of these employed veterans is shown in Table II (40). In the same time period, about .4% of the people in the military in 1970 left this category in 1971 and became unemployed (41). The remaining 61% of these individuals remained in the military category in 1971. Due to lack of data, the percent of the people leaving the military and entering the unavailable category was assumed to be zero.

The supply, that is the number of individuals available to fill work positions, is effected only by the number of people entering employed and unemployed categories in 1971 from the military category. Those people entering the education category are not considered to be available for work.

UNAVAILABLE

The final category of the delivery system for supply is the unavailable category. This category represents all individuals not categorized in previous categories described for 1970. This category can be thought to be composed of individuals who are retired, individuals who are inmates of institutions and others who are not accounted for in other categories. The number of individuals in this category in 1970 and their 1971 occupational distribution is also presented in Table 9.

Existing data from the 1970 Census of the Population permitted an estimate of 872,902 people to be categorized as unavailable for that year. This number can be seen in the total number column of Table 9. Due to insufficient data, the number of these persons who were unavailable in 1970 was assumed to be zero. It was estimated, as seen in the employed column of Table 9, that approximately .8% of these unavailable individuals became employed in 1971. The occupational distribution of individuals who became employed is shown in Table 9. It is important to note that these estimations represent female accessions. That is, the number of females who are reentering the labor force after being unavailable for at least one year for reasons such as marriage or children. It is important to remember that accessions, as used here, does not include "first time" employment. The remaining 865,945 people, 99.2%, who were unavailable in 1970 were still categorized as unavailable in 1971 (42).

Table 9

Military and Unavailable Categories in 1970 by Occupational Category in 1971

1970 / 1971		Post-Sec. College		Post-Sec. Vocational		Professional		Manager		Clerical		- Sales		Craftsmen	
Category	Total Number	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Military	49,555	1,716	3.47	816	1.65	1,685	3.40	2,517	5.08	738	1.49	1,754	3.54	3,662	7.39
Unavailable	872,902					1,157	.13	235	.03	2,387	.27	511	.06	107	.01

1970 / 1971	Operatives		Service		Laborers		Farmers		Unemployed		Military		Unavailable	
Category	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Military	4,189	8.45	852	1.72	1,184	2.39	208	.42	208	.42	30,226	60.59	0	0
Unavailable	747	.09	1,640	.19	70	.01	103	.01	0	0	0	0	865,944	99.20

SUMMARY

This section of the report was an attempt to demonstrate, through the use of a flow matrix, how the supply delivery system works in producing occupational supply in a future time period. The flow matrix indicated the estimated movement of individuals between and within a series of categories which define the entire population of the state of Minnesota between 1970 and 1971.

APPENDIX III

Documentation for Occupational Supply Flow Matrix
for Minnesota, 1970-1971

SOURCES AND CALCULATIONS

(1) U.S. Department of Commerce, Bureau of the Census, 1970 Census of the Population; General Population Characteristics: Minnesota, Washington, D.C.; Government Printing Office, 1971

(2) Same as #1 above

(3) a. State of Minnesota, Department of Education, Statistics Section, Minnesota Public School Statistics for the Year Ending June 30, 1971 Compared with Last Year. p. 3
b. State of Minnesota, Department of Education, Statistics Section Information on Minnesota Non-Public Schools for the Year Ending June 30, 1969-1970-1971. p. 2

$Total_{1970}$ = Public Enrollment + Private Enrollment

(4) Same as #3 above

(5) Minnesota Higher Education Coordinating Commission, Total and Full Time Equivalent Enrollment by Levels in Minnesota Post Secondary Institutions, Fall 1969

(6) Minnesota Analysis and Planning System, 1970 Census Data (Fourth Count) Employment Characteristics

(7) Same as #6 above

(8) Unpublished Data from The Minnesota Headquarters of the Selective Service System

(9) a. Minnesota Analysis Planning System, 1970 Census Data (Fourth Count) Gen. Population Characteristics
b. U.S. Department of Labor, Bureau of Labor Statistics, Tomorrow's Manpower Needs, Volume 1, Developing Manpower Projections, Feb., 1969

$UNC_{70} = R + I + MD + FO$

where: UNC_{70} = estimated number of persons not categorized in any previous category in 1970
R = number of persons over age 65 and not inmates or in the labor force
I = number of persons who are inmates of institutions
MO = number of males not classified in any other category
FO = number of females not classified in any other category

(10) Minnesota Department of Health, Section of Vital Statistics, Minnesota Vital Statistics, 1970, p. 61

$$\text{Infant Death Rate} = \frac{\text{Infant Deaths}}{\text{Births}}$$

Number moving to pre-school = (1.0 - Infant Death Rate) (66,448)

(11) Same source as #10 above. Number dying = (Infant death rate) (66,448)

(12) U.S. Department of Commerce, Bureau of the Census, 1970 Census of the Population: General Population Characteristics: Minnesota (Washington, D.C.; Government Printing Office, 1971)

Number remaining in pre-school$_{1971}$ = (at least age one but under age 4)$_{1970}$

(13) Same source as #12 above.

Number entering pre-school = Number reaching age 5 in 1970

(14) Minnesota Department of Health, Section of Vital Statistics, Minnesota Vital Statistics, 1970, p. 7

$$\text{Age 1-4 Death Rate} = \frac{\text{Deaths in this age group}}{\text{Total number in age group}}$$

Number of deaths = (Age 1-4 death rate) (265,323)

(15) a. State of Minnesota, Department of Education, Statistics Section, Minnesota Public School Statistics for the Year Ending June 30, 1971 Compared with Last Year. p. 3
b. State of Minnesota, Department of Education, Statistics Section, Information on Minnesota Non-Public Schools for the Year Ending June 30, 1969-1970-1971. p. 2

Staying in Elementary School$_{1971}$ = (In elementary category $_{1970}$)
- (Deaths + Individuals in grade 6$_{1970}$)

(16) Same as #15 above

All those individuals in grade 6 in 1970 were considered to enter the secondary category in 1971.

(17) a. Information on Minnesota Non-Public Schools for the Year Ending June 30, 1951, 1970, 1971, State of Minnesota, Department of Education, Statistics Section.
b. Minnesota Public School Statistics for the School Year Ending June 30, 1971 Compared with Last Year, State of Minnesota, Department of Education, Statistics Section.
c. Report on Changes in School Membership, State of Minnesota, Department of Education, Departments of Research, State Aides and Statistics.

Number remaining in secondary category = Number in secondary category in 1970 - (Graduates in 1970 + Dropouts 1970)

Note: figures were combined from a, b, and c above.

(18) a. Minnesota Department of Education, Division of Voc-Tech Education, Program Operations Section. Report No. 037-242, Estimated Number of Students Who Graduated From High School in the 1969-70 School Year by Category. [This report included all secondary students.]
b. Vocational Follow-Up Project - Interim report of Bibliographical Information on Persons who Enrolled in the Full-time Day Programs of the Minnesota AVTS between July 1, 1971 and March 15, 1972, May 1972, Table 12.
c. Minnesota Department of Education - Research, State Aids, Statistics Report on Changes in School Membership July 1, 1969-June 30, 1970.

(19) Same as #18 above

(20) Same as #18 above, references (a) and (c)

Number entering Military in 1971 from Secondary Education in 1970

$$= \frac{\text{Completions who entered Military}}{\text{Number in Secondary Education}} \quad (458{,}991)$$

(21) Same as #18 above, references (a) and (c)

Unavailable in 1971 from Secondary Education in 1970 = (458,991) - Completions and dropouts not categorized in other categories

(22) Department of Health, Education, and Welfare, Office of Education, Washington, D.C., O.E. Form 3139, 5/71. [O.E. Form 3139 is presently used by the Division of Vocational Education for reporting post high school activity of vocational graduates.]

$$N_{71} = E_{71}\ (S_{70}) \times P$$

Where:

N_{71} - number of persons who were in the secondary category in 1970 and employed in a specific occupational area in 1971

$E_{71}\ (S_{70})$ = total number of persons who were in the secondary category in 1970 and in the employed category in 1971

P = proportion of total employed in 1972 from Secondary Vocational category in 1971 who were employed in a specific occupational category (P for each occupational category was calculated using data about 1971 vocational program completions; the assumption was made that 1970 completions were employed in the same proportions as 1971 completions).

(23) a. same as reference #22 above
b. same as reference (a) in #18 above
c. same as reference (c) in #18 above

$$NU_{71} = DU_{71} + GU_{71}$$

Where:

NU_{71} = Number of persons in secondary category in 1970 and in the unemployed category in 1971

DU_{71} = Number of dropouts who were unemployed in 1971

GU_{71} = Number of graduates who were unemployed in 1971

(24) Minnesota Higher Education Coordinating Commission, Total and Full-Time Equivalent Enrolment by Levels in Minnesota Post Secondary Institutions, Fall, 1969, p. 1

Four Year Colleges $\qquad FYC_{71} = FYC_{70} - D_{70}$

Where:

FYC_{71} = four year college enrollment in 1970-71 school year

FYC_{70} = four year college enrollment in 1969-70 school year

D_{70} = degrees granted during 1969-70 school year

Note: Calculations included both public and private colleges and universities in the State.

Two Year Colleges $\qquad TYC_{71} = TYC_{70} - D_{70}$

Where:

TYC_{71} = two year college enrollment in 1970-71 school year

TYC_{70} = two year college enrollment in 1969-70 school year

D_{70} = degrees granted during 1969-70 school year

(25) Vocational Follow-Up Project, University of Minnesota, Interum Report of Biographical Information on Persons who Entered in the Full Time Day Programs of the Minnesota AVTS between July 1, 1971 and March 15, 1972, Table 11.

$$FVS_{71} = NE_{71} \times \frac{FYC_{70}}{FYC_{70} + TYC_{70}}$$

$$TVS_{71} = NE_{71} \times \frac{TYC_{70}}{FYC_{70} + TYC_{70}}$$

Where:

FVS_{71} = number of persons in four year college category in 1970 who entered public or private vocational schools in 1971

NE_{71} = number of persons with 13 or more years of schooling who entered public or private vocational schools in 1971

FYC_{70} = four year college enrollment in 1970

TYC_{70} = two year college enrollment in 1970

TVS_{71} = number of persons in two year college category in 1970 and in public and private vocational school category in 1971

(26) a. Letters from a sample of placement offices across the State.
b. Minnesota Department of Manpower Services, 1971 MDTA Training Highlights.
c. Unpublished Statistical Data from MDTA Statistics Analyst.

$$FYM_{71} = FYG_{70} \times \frac{SM}{SG}$$

$$TYM_{71} = TYG_{70} \times \frac{SM}{SG}$$

Where:

FYM_{71} = number of persons in four year colleges category in 1970 who entered the military category in 1971

TYM_{71} = number of persons in two year colleges category in 1970 who entered the military category in 1971

FYG_{70} = estimated number of graduates from four year colleges

TYG_{70} = estimated number of graduates from two year colleges

SM = number of persons in the sample who entered the military

SG = number of persons in the sample who graduated

(27) Same as reference (a) in #26 above

Number entering unavailable category in 1971 = Number of degrees granted in 1970 - Totals from all other categories.

(28) a. Vocational Follow-Up Project, University of Minnesota, Summary of One Year Follow-Up Information on Graduates who Graduated between July 1, 1969, and June 30, 1970.
b. Department of Health, Education and Welfare, Office of Education, Follow-Up of Program Completions in Secondary and Post-Secondary Vocational Education Programs, O.E. Form 3139, 6/70
c. Unpublished Report from State Department Office that certifies private vocational programs

Number remaining = (Total in 1970) - Completions for both public & private vocational school categories

(29) Same sources as #28 above

$$PVC_{71} = (PVC_{70} \times U) \times CE$$

$$PrVC_{71} = (PrVC_{70} \times U) \times CE$$

Where:

PVC_{71} = number of persons entering college category in 1971 from public vocatioal school category in 1970

$PrVC_{71}$ = number of persons entering college category in 1971 from private vocational school category in 1970

PVC_{70} = completions from public vocational schools

$PrVC_{70}$ = completions from private vocational schools

U = percent of completions unavailable to labor force

CE = percent of unavailable to labor force who continued education

(30) Same sources as #28 above

$PVM_{71} = (PVC_{70} \times U) \times ME$

$PrVM_{71} = (PrVC_{70} \times U) \times ME$

Where:

PVM_{71} = number of persons in the public vocational category in 1970 who enter the military category in 1971

$PrVM_{71}$ = number of persons in the private vocational category in 1970 who enter the military category in 1971

PVC_{70} = public vocational school completions in 1970

$PrVC_{70}$ = private vocational school completions in 1970

U = percent of completions unavailable to the labor force

ME = percent of unavailable to labor force who entered the military category

(31) Minnesota State Board of Health, Vital Statistics, Minnesota 1970

$PVU_{71} = (PVT_{70} \times D) + [(PVC_{70} \times U) \times UE]$

$PrVU_{71} = (PrVT_{70} \times D) + [(PrVC_{70} \times U) \times UE]$

Where:

PVU_{71} = number of persons who were in the public vocational category in 1970 and the unavailable category in 1971

$PrVU_{71}$ = number of persons in the private vocational category in 1970 and in the unavailable category in 1971

PVT_{70} = total number of persons in the public vocational category in 1970

$PrVT_{70}$ = total number of persons in the private vocational category in 1970

D = estimated death rate appropriate for this age group

PVC_{70} = public vocational school completions in 1970

$PrVC_{70}$ = private vocational school completions in 1970

U = percent of completions unavailable to the labor force

UE = percent of unavailable to labor force who enter the unavailable category

(32) Information was collected from a group of two and four year college placement offices. The distribution of graduates from four year colleges was estimated from this information. The primary source was a report from the Center for Career Development and Placement, Mankato State College. The distribution of graduates from two year colleges was estimated primarily from information received from Metropolitan State Junior College.

(33) a. Same as references (a), (b) and (c) in #28 above
b. Same as references (b) and (c) in #26 above

(34) a. Minnesota Department of Manpower Services, 1975 Employment
b. U.S. Department of Commerce, Bureau of the Census, 1970 Census of the Population: General Population Characteristics: Minnesota (Washington, D.C., Government Printing Office, 1971)
c. Minnesota Analysis and Planning System, 1970 Census Data (Fourth Count). Employment Characteristics
d. U.S. Department of Labor, Bureau of Labor Statistics, Special Labor Force Report No. 35 (Bancroft and Garfinkle), "Job Mobility in 1961", Reprint No. 2421 from the Monthly Labor Review, August 1963
e. U.S. Department of Labor, Bureau of Labor Statistics, Special Labor Force Report No. 84 (Saben), "Occupational Mobility of Employment Workers", 6/67

$$EXY_{71} = \frac{[\ (MX_m \cdot OMY_m) + (MX \div OMY_F)\ ]}{TX_m + TX_F} \cdot AM$$

Where:

EXY_{71} = estimated number of persons employed in occupational category X in 1970 and employed in occupation category Y in 1971

MX_m = estimated number of males in occupation X who changed occupations from 1970 to 1971

MX_F = estimated number of females in occupation X who changed occupations from 1970 to 1971

OMY_m = proportion of those males in occupation group X in 1970 who entered occupation group Y in 1971

OMY_F = proportion of those females in occupationa group X in 1970 who entered occupation group Y in 1971

TX_m = total number of males in occupation category X in 1970

TX_F = total number of females in occupation category X in 1970

AM = estimated number of persons in occupation category X in 1970 who are available to move; that is, still in the employed category in 1971.

The above formula was applied to each occupation category in 1970 to obtain the estimated distribution of persons in the categories in 1971.

(35) a. Handbook of Labor Statistics, 1971
b. Minnesota Analysis and Planning System, 1970 Census Data (Fourth Count) Employment Characteristics

$$UX_{71} = TEX_{70} \cdot RATE$$

$$RATE = \frac{[\ (EX_m + UX_m) \cdot URX_m\ ] + [\ (EX_F + UX_F) \cdot URX_F\ ]}{TEX_{71}}$$

Where:

UX_{71} = estimated number of persons who were employed in occupation category X in 1970 and in the unemployed category in 1971

TEX_{70} = number of persons employed in occupation category X in 1970

RATE = estimated proportion of those persons in occupation X in 1970 who would become unemployed in 1971

EX_m = number of males employed in occupation X in 1971

EX_F = number of females employed in occupation X in 1971

UX_m = number of males unemployed in occupation X in 1971

URX_m = unemployment rate for males in occupation X in 1971

UX_F = number of females unemployed in occupation X in 1971

URX_F = unemployment rate for females in occupation X in 1971

TEX_{71} = total number of persons employed in occupation X in 1971

(36) a. Unpublished data from Minnesota Selective Service
b. Richardson, Robert B.; An Examination of the Transferability of Certain Military Skills and Experiences to Civilian Occupations: Thesis, Cornell University, 1967.

$$MX_{71} = ME_{70} \cdot PX$$

Where:

MX_{71} = estimated number of persons who were employed in occupation X in 1970 who entered the military in 1971

ME_{70} = total number of persons who entered the military in 1971

PX = percentage of the persons who entered the service in 1971 who were employed in occupation X in 1970 [calculated for each X from data in source (b)]

(37) a. U.S. Department of Labor, Bureau of Labor Statistics, Tomorrow's Manpower Needs, Volumn 1, "Developing Area Manpower Projections", 1969

b. U.S. Department of Labor, Bureau of Labor Statistics, Tomorrow's Manpower Needs, Volumn IV, "The National Industry - Occupational Matrix and Other Manpower Data", 1969

$$UAX_{71} = (TX_{70} \cdot SRX) + NECX$$

Where:

UAX_{71} = estimated number of persons who were employed in occupation X in 1970 and classified as unavailable in 1971

TX_{70} = total number of persons in occupation group X in 1970

SRX = annual percentage of the people in occupation X who either die, retire or leave the labor force for other reasons

NECX = number of persons in occupation X in 1970 other than those calculated in the previous step who are not classified in any other category in 1971

(38) a. U.S. Department of Labor, Bureau of Labor Statistics, Handbook of Labor Statistics, 1971

b. Minnesota Analysis Planning System, Census Data (Fourth Count), General Population Characteristics

Two assumptions were made: (1) People will re-enter the employed category in the same occupational group in which they were previously employed, (2) people in each occupational group will become unavailable in the same proportions as people in the employed category become unavailable.

$$EX_{71} = NAX_{70} \cdot K_E \qquad UX_{71} = NAX_{70} \cdot K_U \qquad UAX_{71} = TX_{70} \cdot PX$$

Where:

EX_{71} = estimated number of persons classified as unemployed from occupation X in 1970 and employed in 1971

UX_{71} = estimated number of persons classified as unemployed from occupation X in 1970 and unemployed in 1971

UAX_{71} = estimated number of persons who were categorized as unemployed in 1970 and unavailable in 1971

UAX_{70} = estimated number of persons who were categorized as unemployed in 1970 and previously employed at occupation X

NAX_{70} = number of persons available in 1970 to enter the labor force from occupation X

K_E = constant proportion (.943) of the persons unemployed in 1970 who remain unemployed for less than 27 weeks

K_U = constant proportion (.057) of the persons unemployed in 1970 who remain unemployed for 27 weeks or more

TX_{70} = total number of persons in the unemployed category in 1970 from occupation X

PX = proportion of the persons in the unemployed category from occupation X who die, retire or leave the labor force for other reasons or are not classified in other 1971 categories

(39) a. Unpublished data from Selective Service System, State Headquarters, St. Paul, Minnesota
b. Richardson, Robert B.; An Examination of the Transferability of Certain Military Skills and Experiences to Civilian Occupations; Thesis, Cornell University, 1967.

$$EM_{70} = ND_{70} \cdot PS$$

Where:

EM_{70} = estimated number of persons who were in the military category in 1970 and in an education category in 1971

ND_{70} = estimated number of persons discharged from the military in 1970

PS = percent of those persons discharged in 1970 who become students in 1971. (Calculated from data in (b) above, based on a study of air force personnel and assumed to be constant for all services.)

(40) Same sources as #39 above

$$XM_{71} = (OD_{70} \cdot POX) + (ED_{70} \cdot PEX)$$

Where:

XM_{71} = estimated number of persons who entered occupation category X in 1971 from the military category in 1970

OD_{70} = number of officers discharged from the military in 1970

ED_{70} = number of enlisted men discharged from the military in 1970

POX = estimated percentage of the officers, discharged from the military, who entered occupation X

PEX = estimated percentage of the enlisted men, discharged from the military who entered occupation X

(41) Same sources as #39 above

$UM_{71} = ND_{70} \cdot PUE$

Where:

UM_{71} = estimated number of persons who entered the unemployed category in 1971 from the military category in 1970

ND_{70} = number of persons discharged from the military services in 1970

PUE = percent of the discharged persons who became unemployed

(42) a. Minnesota Analysis Planning System, 1970 Census Data (Fourth Count): General Population Characteristics.
b. U.S. Department of Labor, Bureau of Labor Statistics, Tomorrow's Manpower Needs, Volumn 1, Developing Manpower Projections, Feb., 1969.

It was assumed that only persons in the female others category would be available to reenter supply to any significant degree. An estimate of the number of females entering the employed category from the unavailable category was found by computing female accessions by age as shown in Table 1.

TABLE 1

Estimated Percentage and Number of Accessions to the Female Labor Force by Age Groups

Age Group	Number in Total Population 1970	Accession Rate	Number of Accessions 1971
25-29	124,817	.76	949
30-34	104,086	1.14	1,187
35-39	97,444	1.50	1,462
40-44	102,028	1.44	1,163
45-49	102,738	1.02	1,048
50-54	98,813	.64	632
55-59	91,464	.38	348
60-64	80,616	.21	169
25-64	802,006	.87	6,958

It should be noted that although the number of accessions are calculated from the total female population in the State, these accessions come from only the female others sub-group of the unavailable category. This sub-group is composed of those females who are not retired, housewives and institutionalized.

The distribution of female accessions was estimated by allocating the total number of accessions across the nine occupational categories in proprortion to the number of females in each occupation. This allocation is shown in Table 2.

TABLE 2

Allocation of Female Accessions

Occupation Category	Number of Females Employed	Percent of Total Number of Females Employed	Number of Accessions
All Occupations	538,231*	100.00	6,958
Professional	89,526	16.63	1,157
Managers	18,181	3.38	235
Clerical	184,666	34.31	2,387
Sales	39,569	7.35	511
Craftsmen	8,272	1.54	107
Operatives	57,748	10.73	749
Service	126,871	23.57	1,640
Laborers	5,373	1.00	70
Farmers	8,025	1.49	103

*Does not include 27,532 who did not report occupation